DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

METAL FINISHING

FEBRUARY, 1952 VOLUME 50 • NUMBER 2

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COMING SOON

A discussion of plating's new wonder chemicals, the chelating agents, and how they can improve or revolutionize plating processes.

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Methods for the chemical analysis and control of alkaline cleaners.

A review of current silver plating practice, including silver electroforming.

Founded as Metal Industry, January, 1903
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The WASHINGTON OBSERVER

George W. Grupp

News and Views from The Nation's Capitol

• The amount of metals available for civilian consumption will be reduced again during the second quarter of 1952.

• The total military expenditures for the last six months of 1951 amounted to $19.0 billion, as compared with $7.7 billion for the same period in 1950.

• The State Department is taking up talks with Bolivia to settle the price dispute between the R.F.C. and the Bolivian tin mining interests, with the hope of increasing the flow of this critically short metal to our stockpile. U.S. tin supplies are at an all-time low. NPA is urging industry to explore every means of conservation.

• N.P.A. plans to increase its controls on metals by placing lead scrap under controls soon.

• Cadmium is presently being produced in the U.S. at the rate of about 8,000,000 pounds per year.

• In the recently revised "List of Basic Materials and Alternates No. 4" the D.P.A. suggests that bright zinc plating, extra-fine aluminum pigment synthetic enamel, and aluminum-base baking enamel should be substituted for chrome and nickel plating.

• The production of copper, lead and zinc in the United States during 1952 will be stepped up from 5 to 10% over 1951. There will also be expected to be increased imports of these metals in 1952.

• "Government-Owned Inventions for Free Use", which sells for $1 a copy at any of the Commerce Department field offices, lists 2,339 patents owned by the U.S. Government and available to American businessmen for use without charge.

• The joint committees of the Specialty Transformer and Fluorescent Lamp Ballast industries have reported to the NPA that corrosion can be curbed by silver plating the copper-aluminum joints used in their products.

• The Federal Government will have to do a considerable amount of borrowing in 1952, since Congress is not expected to increase taxes. Federal income for the fiscal year ending June 30, 1952 is expected to total $72.0 billion, as compared with $63.5 billion for the fiscal year 1951. But in spite of this increase in income the deficit for '52 is expected to amount to $13.0 billion, as compared with $7.3 billion for 1951.

ABLISHED 1903

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METAL FINISHING

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We Salute

The end of year 1951 brought with it the retirement of two of the United States' top authorities on electroplating and metal finishing. We take this opportunity to acknowledge the outstanding contributions made by these men, and to wish them many years of good health to enjoy their retirement. To their successors, we extend all our cooperation in the promotion and encouragement of metal finishing knowledge and practice throughout the world.

RETIRED

Dr. William Blum

Chief-Electrodeposition Section
National Bureau of Standards

Born in 1881, Dr. Blum graduated in 1903 from the University of Pennsylvania. He joined the NBS in 1908, heading the Electrodeposition Section several years later. Best known for his book (with co-author *G. B. Hogaboom*), he is also honored as a teacher of younger men and as a scholar and author.

Recipient of many awards and honors, Dr. Blum is an Honorary Member of the A.E.S. and a past president of the Electrochemical Society.

HIS SUCCESSOR

Dr. Abner Brenner

Born in 1908, Dr. Brenner is a graduate of Missouri University. He came to the Bureau of Standards in 1930, and is best known for his development of the plating thickness tester. He has also done outstanding research on cathode films, electroless nickel plating, and stress measurement in electrodeposits.

He has twice won the A.E.S. Proctor Award, as well as a Dept. of Commerce Award for Meritorious Service.

RETIRED

William M. Phillips

Head—Electrochemistry Dept.
General Motors Research Division

Born in 1887, Bill is also a graduate of the Univ. of Penn. He joined General Motors in 1921. He is best known for his efforts to improve the standards of commercial electroplating, and for developing copper and nickel plating baths. He is a past President of the A.E.S., and has served for many years on A.S.T.M. committees.

He has twice been a winner of the A.E.S. Gold Medal and a special Navy Award for Meritorious Servive.

HIS SUCCESSOR

Cleveland F. Nixon

Born in 1901, Cleve graduated from Wisconsin University, where he studied under Dr. Watts. He has been at General Motors Ternsted Division since 1930 as Director of Process Engineering.

He is presently President of the A.E.S., and a Gold Medal Winner. He is best known for his work in the quality control of plating in mass production, as well as process simplification.

W. A. Raymond

Editor

Industrial Finishing Exposition Shapes Up

MORE than one-third of the exhibit space at Chicago's International Amphi-theater has been reserved by exhibitors participating in the 3rd Industrial Finishing Exposition sponsored by the *American Electroplaters' Society*. The Exposition, scheduled for June 16-20, 1952, is expected to attract 20,000 purchasing and production executives from all branches of industry.

Clyde Kelly, Exposition and Convention Chairman, has announced that hundreds of products and services in the electroplating and allied fields will be displayed at the Chicago Exposition. The scope of the exhibits has been enlarged to cover abrasives, automotive plant transportation, basic chemicals and metals, industrial tapes, material handling equipment, polishing and buffing equipment and supplies, testing instruments, and publications dealing with educational and technical phases of the metal finishing industry.

In developing the floor plan for the Exposition, which includes the Arena and the North Wing of the International Amphitheater, the Committee reserved approximately 50,000 square feet for broad aisle space. This insures ample room for material and crowd movement, and guarantees exhibitors the opportunity to show their wares and to talk to buyers without the traditional "cramped quarters" found in most trade expositions.

Careful screening of Exposition visitors and registrants will be made for the protection of exhibitors and their personnel. Curiosity seekers and casual "drop-ins" will not be admitted to the Exhibit Halls. Constant emphasis will be placed on inviting only men and women from industry who influence the buying habits and procedures of their respective companies.

Hours for Exposition attendance have also been announced. The schedule is as follows:

Monday, June 16—12:00 Noon to 10:00 P.M.

Tuesday, June 17—9:00 A.M. to 5:00 P.M.

Wednesday, June 18—12:00 Noon to 10:00 P.M.

Thursday, June 19—9:00 A.M. to 5:00 P.M.

Friday, June 20—Exhibitors' "get-away day."

The Educational Sessions of the 39th Annual Convention of the American Electroplaters' Society will be conducted at the famed Stock Yard Inn, adjacent to the International Amphitheater. These sessions are a vital portion of the Convention, which will otherwise be held concurrently at Chicago's Conrad Hilton Hotel (formerly the Stevens). Free bus service between the Hilton and the Amphitheater is being provided. This transportation will be available to Convention registrants and Exposition Exhibitors exclusively.

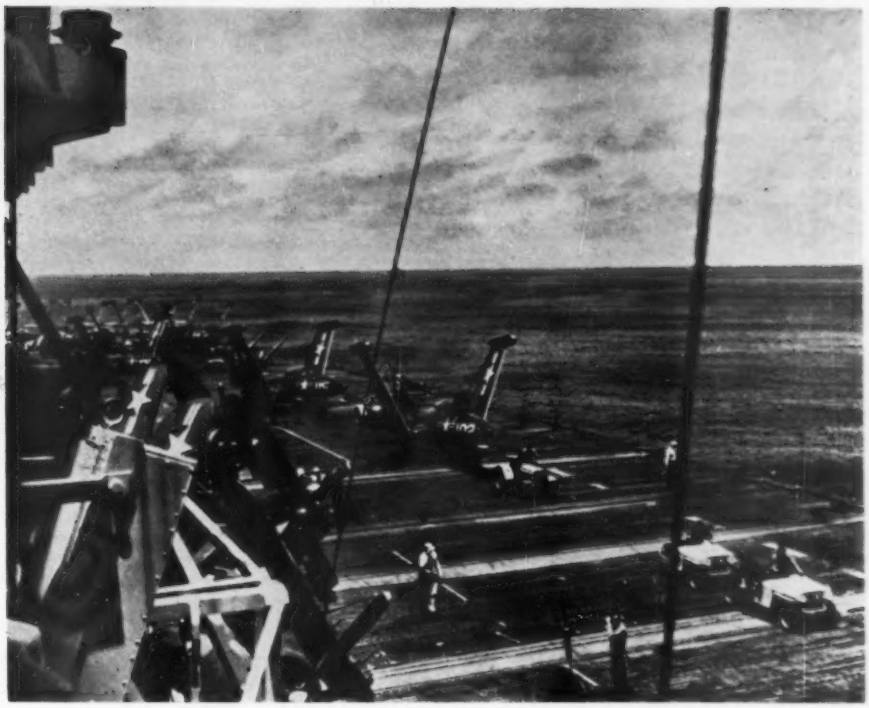
Free facilities for parking 4,000 automobiles has also been arranged by the Exposition Committee.

The A.E.S. Research Division will maintain an extensive exhibit at the Industrial Finishing Exposition. *Harold J. Wiesner*, Chairman of the Committee in charge of the Research Group Exhibit, points out that the primary purpose of the exhibit will be to acquaint large numbers of Industrial representatives with the accomplishments of the Society and with the research work that it is undertaking. A great portion of the animated exhibit will describe the projects being conducted by A.E.S. Research in colleges and universities throughout the United States.

Another educational exhibit already past the planning stage will be that of the Chicago Electroplaters Institute. Methods of plating on various metal objects, as well as a display of metal finishes, will be graphically shown. The job shop platers organization has announced that its display will be unique and extremely mobile.

Dr. H. J. Weisner
Chairman of Research Exhibit

Marion Longfield
General Co-chairman



Carrier based Panther jets get ready for a strike over Korea's hills. Note bare leading edge on wings, fabricated from aluminum alloy, protected only by an anodic film.

Surface Treatment and Plating in Naval Aircraft*

By Gordon S. Mustin, *Airborne Equipment Division, Bureau of Aeronautics, Washington 25, D. C.*

Introduction

CORROSION prevention is essential to the performance of naval aircraft missions. This thesis and means for accomplishing this objective have been stated in somewhat elaborate detail in another paper.[1] The present paper is a discussion in greater detail of the surface treatments and platings used in preventing undesired corrosion with a view to clarifying the background for the specifications most likely to be encountered in naval aircraft work.

Aircraft Materials

Naval aircraft normally are fabricated from the following materials:

a. The airframe is essentially constructed from high strength aluminum alloys with the clad alloys, such as 72Clad75S, 2SClad24S, R301 or clad 14S predominant in skin sheeting. Some of the more recent airplanes employ sandwich material in which the bread of the sandwich is a relatively thin sheet of clad aluminum alloy and the meat is end grain balsa, plastic or metal honeycomb, or possibly plastic foam.

b. Arresting hooks, armor plate, bolts, turnbuckles and other fittings, landing gear, guns, antifriction bearings, engine mounts, firewalls, exhaust stacks and cones, major engine parts, wing hinges and locks and a host of small operating parts in valves and other equipment may be fabricated from various types of steel, both stainless and non-stainless, with selection primarily resting upon the specific properties desired.

c. Wheel and brakes, certain engine components, valve housings, instrument cases and non-structural parts such as instrument panels, etc., are usually fabricated from magnesium alloy.

d. Extensive amounts of natural and synthetic rubber are used in the fabrication of self sealing fuel and oil cells, hose, gaskets, packings, O-rings, vibration isolators, tires, tubes and grommets.

e. While not too common in present combat aircraft, plywood and laminated woods have been used for control surfaces and are still common as floorings in transports.

f. Fabrics of various types are common in the control surfaces of light aircraft and are used in insulating and soundproofing materials.

g. Plastic materials are to be found throughout the

**The opinions expressed herein are those of the author and do not necessarily represent the views of the Department of the Navy.*

Table I—Climatic Hazards

Arctic — Slight
Subarctic — Same as Temperate in Summer
Temperate — U. S. typical
Tropic (Desert) — Condensation at night
Tropic (Rain Forest) — Heat, Humidity, Fungus, Insects

Table II—Operational Hazards

High Altitude — Cold and Condensation on return
Ocean Spray
Stack Gases
Vibrations
Deck De-Icing
Unpaved Runways — Coral, Volcanic Ash, Dirt or Gravel

Table III—Operating Materials Hazards

Salt Water Displacement Fueling Systems
Gasoline Combustion Products
Rocket Fuels and Combustion Products
Water-Alcohol Mixtures — Water Injection, De-Icing
Heat De-Icing
Hydraulic Fluids
Synthetic Lubricants
E. P. Lubricants
Drift Markers
Seaplane Mooring Facilities
Gun and Rocket Gases

Table IV—Construction Factors

Heat Treatment
Cold Work
Welding
Heat Treat Salts
Cutting Oils
Marking Fluids
Shop Dirt

airplane from cockpit hoods to electrical insulating materials.

h. All the other common metals such as brass, bronze, copper and nickel alloys can be found where their specific properties make them useful.

All of the materials mentioned corrode with varying readiness or directly affect corrosion of the other materials listed. Any of the standard treatises on corrosion such as the *Corrosion Handbook*[2] describe these factors in greater detail.

Hazards

Naval aircraft are exposed to many corrosive environments most of which have been summarized in greater detail by *Promisel* and *Mustin*.[1] For purposes of completeness, however, the essential hazards are summarized here in Tables I through IV.

Role of Surface Treatment and Plating

The battle to prevent corrosion is always with us and begins with the selection of the most corrosion resistant materials compatible with the other properties needed. Care is taken to insure that all alloys are properly heat treated and that such factors as free drainage, avoidance of dissimilar metal contacts, etc., are properly considered. When these features are satisfactorily incorporated in the design, protection of a corrodible alloy in a corrosive medium is usually sought either by employing a more or less impermeable seal or mechanical barrier, or by reducing the corrosivity of the medium actually reaching the surface through the use of corrosion inhibitors. The two means may be employed simultaneously, as with inhibitive primers and paints, or they may be employed alone, as in the case of cathodic electroplated surfaces, dehydration, hermetic sealing or vapor phase inhibitors.

Figure 1. Armed to the teeth, veteran Corsair fighters prepare for takeoff to engage in action against North Korean forces. Note crowded conditions and close teamwork of flight deck crews. Any corrosion which occurs interferes with this efficiency.

Where additional protection of the basic strength member is desired and it is felt that either the paint is not sufficient protection or, for any reason, paint is not practicable, then protection for the particular member is provided by allowing some other metal in contact therewith to corrode sacrificially. Examples of the latter are the use of metal coatings anodic to the protected metal such as cadmium or zinc plating and the like for steel, or the use of anodic metals in the form of readily replaceable parts such as washers.

It can readily be seen that surface treatment and plating, whether or not subsequently painted, play an essential role in naval aircraft corrosion prevention work.

The subject of painting and application of the other corrosion prevention techniques is not within the scope of this paper. A more detailed discussion may be found elsewhere.[1]

Cleaning

It goes without saying that proper cleaning is essential if final success is to be achieved. Cleaning requirements placed on contractors are as shown in Table V. It will be noted that, generally speaking, the requirements stated in this table leave much to the discretion of the operator. This is because the cleaning prior to application of plating or surface treatment intimately affects the success of the final job, the optimum procedural details are dictated by local conditions, and the manufacturer is contractually responsible for the per-

formance of this finish. For overhaul purposes within the Navy, considerably more control is exercised, and the use of specification materials and processes is stressed. Local differences in the quality of water, equipment and personnel available, however, call for slightly different techniques, and local autonomy is granted in these matters with the materials laboratories of the various Naval Air Stations exercising suitable controls.

General Requirements

The general requirements covering all aircraft metals are shown in Table VI. The selection of the specifications listed has been based on the policies of the Bureau of Aeronautics covering the use of the various specifications and standards from which selection may be made. Airframe and airframe accessory manufacturers follow the principles set forth in Air Force Navy Aeronautical Bulletins 143 and 147. In essence these two bulletins prescribe the following priority for specifications and standards:

1. Federal
2. Military or Joint Army Navy
3. Air Force Navy Aeronautical
4. Navy Department
5. Other Government (such as bureau or office specifications and uncoordinated military specifications).
6. Non-government standardizing organization's documents such as ASTM, SAE, etc.
7. Company standards.

Some of the specifications listed in this and subsequent tables are not yet listed in the Index. On the other hand, familiar specifications are not listed in Part III of the Index and some of these others may well be referenced in contracts or orders for aeronautical equipment which may be received. These tables should, therefore, be considered as only representing the most probable specification which may be referenced.

One of the most important objectives of the current program of converting all departmental, bureau and

Figure 2. Flight deck crews of the USS BADOENG STRAIT clear the flight deck after an icy storm which swept out of Manchuria. Soon after this picture was taken, Marine Corsairs were again taking off to harass enemy ground forces. Rock salt, used to prevent freezing on the landing deck, has a severe corrosive effect on most aircraft materials.

Table V—Metal Cleaning Requirements

(From MIL-S-5002)

1. General Rule:	Clean with materials and processes having no deleterious effect on the metal and producing surfaces satisfactory for application of surface treatment required. Specifications and operating conditions shown in Nav Exos P-938 not mandatory on contractors.
2. Aluminum Alloys:	Uninhibited alkalies and abrasives prohibited.
3. Steel Armor Plate:	Acid pickling or other processes capable of hydrogen embrittlement prohibited.
4. Corrosion and Heat Resistant Alloys:	Pickle and passivate (either forced or natural).
5. Other Steels:	Any of processes of JAN-C-490.
6. Magnesium:	Only those operations detailed in MIL-M-3171 permitted.
7. Flux Removal:	Required to satisfaction of inspector.
8. Use of Carbon Tetrachloride:	Forbidden.

Table VI
Normal Surface Treatment Requirements

Material	*Type Treatment*	*Airframe Spec.*	*Engine Spec.*	*Remarks*
Steel (except C.R.S. & H.R.S.)	Cadmium Plate or Zinc Plate	QQ-P-416 AN-P-32	AMS 2400 AMS 2402	Exceptions include usages of Tables VII and VIII, parts welded to unplated structure, cable and wire, bearings and journals, armor plate.
Corrosion and Heat Resistant Alloys	Clean	—	—	Electroplated when in contact dissimilar metals.
Brass, Bronze and Copper	Clean	—	—	Electroplated when in contact with dissimilar metals.
Magnesium	Chemical Surface Treatment	MIL-M-3171	AMS 2475	—
Aluminum	Anodize, Chemical Surface Treatment or Wash	—	—	See Table IX.

office specifications to coordinated Military or Federal documents is the elimination of the vast number of specifications which may rise to plague sub-contractors working for several principals. Inasmuch as care is taken to include requirements which may be peculiar to aircraft work in each Federal or Military specification covering plating and surface treatment, it is believed that this objective is being approached, slow as progress may seem.

The aircraft engine industry operates on a slightly different procedure. For reasons too complex to review here, they follow principles set forth in Air Force-Navy Aeronautical Bulletin 343 where only those government standards considered absolutely essential to the performance of the engine or its accessories are listed as mandatory. Otherwise SAE Aeronautical material specifications are usually followed and they have been listed as applicable for aircraft engines.

As will be seen from Table VI, the most commonly used treatments on steel are cadmium and zinc plating. These are excellent not only because of the anodic protection of steel but also because of their close position in the electromotive series to magnesium and aluminum for dissimilar metal contact protection. The cadmium is usually 0.0003″ thick and without supplementary treatment (Type I, Class B of QQ-P-416) while the zinc is normally 0.0005″ thick with treatment to withstand 100 hour salt spray. Generally speaking the two types of plating are considered interchangeable with the major exception arising from the known deleterious effects of zinc on corrosion resistant steels at high temperatures. Attention is drawn to the close correlation between the thickness and other performance requirements of these specifications and the A.S.T.M.-A.E.S. series of specifications, a matter which has been explored in some detail by *Ogburn*.[3] This trend is continuing. For example, the proposed Federal specification for zinc plating (QQ-Z-381) has the same thicknesses as A.S.T.M. A164 with the exception of the thinnest, which is to be 0.00020″ instead of 0.00015″.

Alternate Plated Coatings for Steel

The number of exceptions to the basic rule just given is quite large. Table VII shows the 12 electrodeposited coatings which are often found in aircraft work, summarizing the specifications used and the primary reasons for their selection.

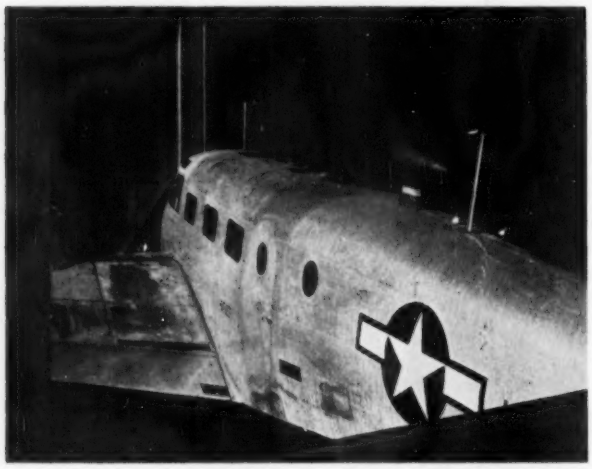


Figure 3. Salt spray caused this general surface corrosion of Clad 24ST aluminum alloy which was neither surface treated nor painted. Although not affecting strength, this corrosion grounded plane and required many manhours to correct.

Figure 4. Ship's stack gases corroded this wing.

The hard chromium plating specification actually contains two types, decorative and hard, with usage of the former practically nil. Type II is required to be applied directly to the basis metal and its nearest A.S.T.M.-A.E.S. counterpart is the tentative process standard, B177.

Corrosion in operating engines almost always occurs first in the cylinder area because of the high concentration of corrosive by-products. While a small amount of surface corrosion does no harm, the development of a very small amount of pitting in the area of ring travel greatly increases ring wear, leading to high oil consumption. The use of porous chromium plating to combat this condition in aircraft engine cylinders is on the increase. The type of plating found to be most successful in aircraft engine cylinders is the channel type covered by Air Force specification 20031, and not the pinpoint type prescribed by AMS2407. Bureau of Ships ad interim specification 46P3(INT) is not used in aircraft work because it permits either the channel or the pin

Table VII

Alternate Electrodeposited Coatings

Type	*Airframe Spec*	*Engine Spec*	*Primary Usage*
Chromium (Hard)	MIL-P-6871	AMS 2406	Wear and abrasion
Chromium (Porous)	AAF 20031	.....	Wear and abrasion in engine cylinders.
Nickel	MIL-P-6859	AMS 2403	Hi-temp. Dissimilar metals.
Tin-Cad.	.....	.....	Corrosion and wear.
Tin	AMS 2408 AMS 2409	AMS 2408 AMS 2409	Anti-galling
Lead	AMS 2414	AMS 2414	Anti-galling
Indium	.....	.....	Anti-galling (rarely used alone).
Lead-Indium	AMS 2415	AMS 2415	Anti-galling
Silver-Lead-Indium			anti-galling
Copper	AMS 2418	AMS 2418	Anti-seize
Silver	AMS 2410	AMS 2410	Electrical Conductivity and anti-galling
Gold	.....	.....	Electrical Conductivity

Table VIII
Non-Electrodeposited Coatings for Steel

Type	Airframe Spec	Engine Spec	Primary Usage
Metal Spray	AN-M-8	.....	Parts too big for plating bath or too difficult to clean.
Hot Dip Zinc or Tin	.....	.....	Special applications only.
Phosphate (Heavy)	MIL-C-16232 (Ord) Type II	.....	Guns, some engine parts.
Phosphate (Paint Base)	JAN-C-490 Grade I	AMS 2480	Non critical steel parts of landplanes. Ground equipment.
Phosphate (Oiled)	MIL-C-16232 (Ord) Type I	AMS 2481	Engine parts, guns, internal working surfaces where plating impractical or undesirable.
Black Oxide	AMS 2485	AMS 2485	Parts continuously coated with oil.

point type interchangeably. Stripped to its essential details the proper type of plating may be obtained by making the work the anode in a 33 oz./gal. chromic acid bath maintained at 122° ± 3°F. for approximately 15 minutes at a current density of 2.0 amps./sq. in. and then transferring to a plating bath containing 33 oz./gal. chromic acid, sulfate ratio 110-140 to 1, and a temperature between 139°F. and 150°F. Plating is normally 1.5 thousandths more than finished dimension. Care must be taken to insure that the temperature does not vary more than ½ degree during plating.

Figure 5. Corrosion in a gyro stabilizing device caused by the corrosive byproducts of fungus growth.

Figure 6. Corrosion of a bomb rack installation caused by standing salt water. Post is magnesium alloy, side of bomb rack stainless steel, clip aluminum and nut and bolt cadmium plated.

Time will depend upon the thickness of plate to be applied. After plating the work is again made the anode in a 33.0 oz. per gallon chromic acid bath without added sulfate at a temperature of 122°F. to 140°F. at the exact amperage and for the exact time needed to produce the desired plateau size, channel depth and width and final dimension with flattening of plateau tops by honing. Local standards for computing the processing times have been carefully established and good production results are being obtained.

The consumption of nickel plate is not too high in naval aircraft because of the rather restrictive usages assigned. With increased usage of jet engines, with their very high temperatures, its incidence is naturally on the increase. One engine manufacturer has found it expedient to use nickel on 12% chrome steel compressor blades. During intermittent operations, with the airplanes spotted on the flight deck, corrosion occurred which required more than 50 man-hours per engine to remove; a removal required to restore compressor efficiency. It is interesting to note that another manufacturer is apparently attempting to avoid the disadvantages inherent in the cathodic nature of nickel to most steels by combining nickel and cadmium in much the same manner as will be discussed under tin-cadmium. Few data are available at present on the actual performance of the plate. It is particularly interesting to note that, after plating cadmium on nickel from conventional baths the two coatings are interdiffused by heating for 30 minutes at 630°F. No specifications have been listed for this plate because it appears to be just emerging from the experimental stage.

The cadmium-tin plate is used quite extensively on internal steel parts of aircraft engines by Naval Air Station, Pensacola, and equipment for its application at other air stations is being installed as budgetary considerations permit. This plate was chosen because it possesses essentially the same anti-galling characteristics as tin plate while being anodic to steel. The properties of this plated coating have been extensively investigated in the laboratory at the Naval Air Experimental Station and exhaustive service tests have been conducted in engines. Salt spray resistance of this plating is very much better than that achieved by

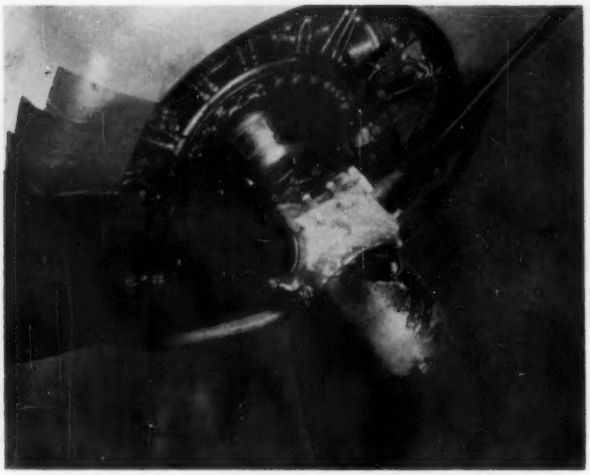


Figure 7. Corrosion of a zinc plated propeller hub.

cadmium or zinc, e.g. 1000 hours vs. 120 hours at .0001" thickness. This improvement has not, however, been substantiated in atmospheric exposure tests, where the difference does not seem to be substantial. A surprisingly small amount of material is required for an engine to achieve the protection desired. Pensacola Naval Air Station, for example, applies a coating approx. 0.0001 inch thick and has estimated that only about 10 grams of material were consumed in plating the internal steel parts of a medium sized engine. Solution potential measurements in molar sodium chloride measured against a 0.1 N potassium chloride-calomel electrode at 27° C. gave results approximately as follows:

Magnesium (FS-1h)	—1.70
Zinc	—1.15
Cadmium	—0.90
Cadmium-Tin	—0.86
Aluminum (24ST)	—0.73
Iron	—0.72
Tin	—0.64

From the above it will be seen that cadmium-tin in contact with magnesium might not be so useful as straight zinc or cadmium plating because it is desired that the potential difference be as small as possible to minimize the attack. Limited dissimilar metal couple tests in distilled water tend to confirm this slight theoretical difference in the case of couples with magnesium. In more severe environments the behavior of magnesium is so bad in contact with any other metal (with the possible exception of 56S aluminum used for riveting) as to obscure any minor differences between the solution potentials of cadmium and cadmium-tin.

As currently used by the Navy the coating is applied by plating 0.00005" tin from a conventional stannate acetate bath followed by an equal amount of cadmium from a cyanide bath. The work is then baked for 30 minutes at 340° to 350°F. to obtain a coating containing approximately equal proportions of the two metals. An interesting variation of this has been the simultaneous disposition of the two metals to the same total thickness from an acid fluoborate bath reported by *Scott* and *Gray*.[4] The resultant plate has approximately 75% cadmium and 25% tin. Tests of this coating at the Naval Air Experimental Station have not been nearly so complete, but improvement in performance over the earlier method is indicated.

Table IX—Surface Treatments for Aluminum

Type	*Airframe Spec*	*Engine Spec*	*Remarks*
Anodic	AN-QQ-A-696	AMS 2470	.....
Chemical Conversion	MIL-C-5541	.....	Not on exterior of seaplanes.
Chromic Acid Wash	.....	.....	Corrosion resistant alloys* of low speed landplanes and electronics.
Alcoholic Phosphoric Acid Wash	.....	.....	Electronics and corrosion resistant alloys* of transport and trainers.
Caustic etch	.....	.....	Electronics only.

**2S, 3S, 52S, 53S, 61S, 72S and all clad alloys.*

The various anti-galling platings listed find their largest use in plain bearings, hence in engine work. Methods of choosing between them are not within the scope of this paper. Their corrosion resistance properties are distinctly secondary but do exist, as would be expected in properly applied cathodic coatings of this nature.

Silver and gold are used primarily in electronics work, silver for electrical contacts and fittings. Gold has been used in wave guides where general surface conductivity is desired.

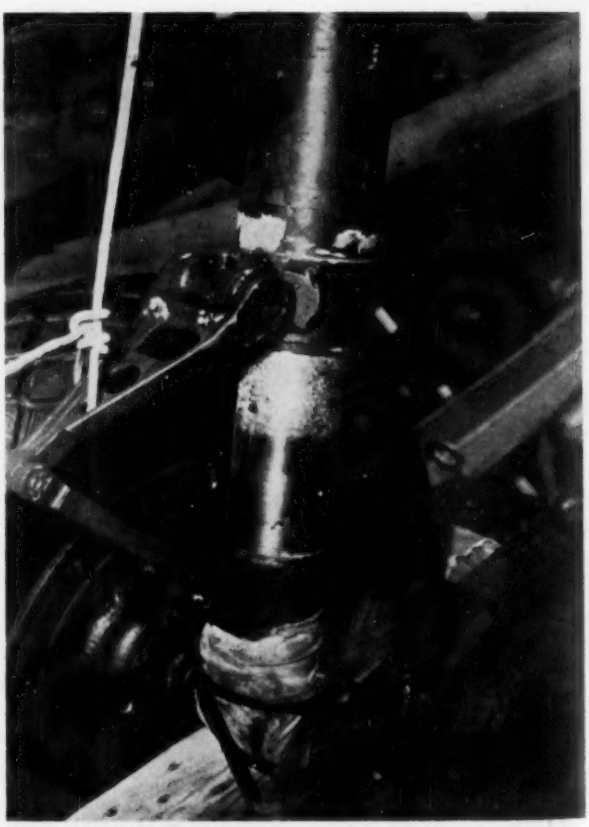


Figure 8. Pitting corrosion of a chromium plated landing gear oleo strut. Minor pitting leads to cutting of hydraulic seal and subsequent leakage, with possible serious results.

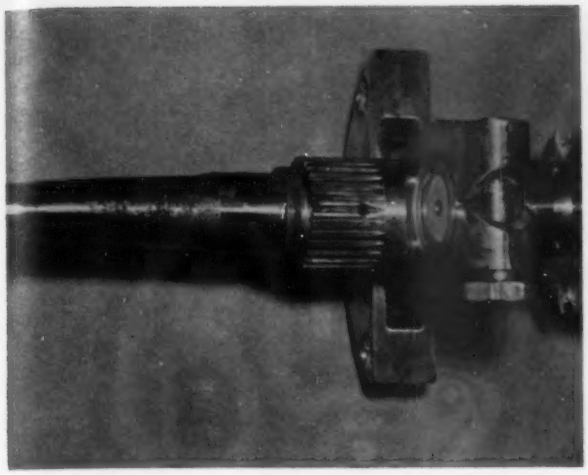


Figure 9. Corrosion of an unplated propeller shaft. Consideration is being given to the use of Cadmium-Tin plating for these parts.

Other Coatings on Steel

Table VIII summarizes the other coatings for steel and their primary uses. Metal spraying is no longer a common technique in modern aircraft production because of the gradual deemphasis of tubular steel structures. Engine mounts of seaplanes are still so treated as well as large landing gear parts. Interest may be expected to revive with increased usage of high strength steels subject to hydrogen embrittlement. Either zinc or aluminum may be used, with the latter preferred where it is necessary to take advantage of its higher heat conductivity. Thus, aluminum spray was quite commonly used in reconditioning corroded cast aircraft engine cylinder fins. For forged fins it is usually simpler to replace the entire fin assembly.

Hot dip coatings such as galvanizing, sherardizing and hot dip tin are rarely found inasmuch as the electroplated coatings are generally considered more applicable to parts requiring close tolerances and high performances. Obviously, also, conservation of tin is a very real necessity, thus favoring electrodeposition wherever practicable.

Usage of the other coatings appears largely self explanatory. The biggest single usage in aircraft work remains the phosphate coating prior to painting on non-critical parts of landplanes. These may be zinc, maganese or iron phosphate type coatings. A useful discussion of the various types was recently published by *Douty*.[35] AMS2485 black oxide treatments are required to be applied in boiling aqueous alkali baths. These coatings have been discussed recently by *Meyer*.[5]

Table X—Minimum Weight for Corrosion Resisting Anodic Coatings

Type Coating	*Milligrams per Square Foot*
Uncolored Chromic Acid	200
Colored Chromic Acid	500*
Uncolored Sulfuric Acid	1200
Colored Sulfuric Acid	2500*

**For some colors higher weights may be necessary to achieve color stability.*

Aluminum Alloy Treatments

Table IX illustrates the interrelationships between the various surface treatments commonly used on aluminum, with the first two representing the maximum usage. The two coatings are essentially interchangeable under the specifications except for the exterior surfaces of seaplanes and in those special applications where extra hardness is desired or special colors for identification purposes are needed. Caustic etch has no particular function as a corrosion inhibitive coating in its own right but is used in electronic work where positive connections must be made. There are preliminary indications that some of the coatings meeting MIL-C-5541 may be useful for this type of work and testing to establish practical maximum surface resistances is being undertaken.

When aluminum alloys were first introduced into aircraft (The Germans in Zeppelins prior to World War I are generally considered to have been the first to make any significant structural usage), surface treatment techniques were somewhat rudimentary. Development rapidly brought to the fore the familiar alcoholic-phosphoric type washes which are still giving yeoman service in many applications. When the work of *Bengough* and his co-workers[6,7] became available, considerable interest in the use of chromic acid anodizing was evinced by all concerned. Chromic acid anodizing was, therefore, used on the *Akron* and the *Macon* by Goodyear Aircraft in the late 1920's. Coincidentally, these were the first two all aluminum aircraft procured by the Navy. The Bengough patent was, unfortunately for the inventor but fortunately for the initiative it engendered, a little too precise in describing concentrations and other operating conditions, with the result that many investigators in this country undertook studies leading to the development of improved processes and greater knowledge of the basic mechanics of the process. In the chromic acid process *Buzzard* and *Wilson*[8,9,10] led the way to what are commonly called the 10% chromic acid baths. For the most part, operations of these types of baths are controlled in accordance with the procedures laid down by *Tarr, Darrin* and *Tubbs*.[11] The other major direction taken was in the field of sulfuric acid coatings. The film forming char-

Figure 10. Internal corrosion in an aircraft engine. These parts are now to be Cadmium-Tin plated at overhaul.

acteristics of the sulfuric acid baths had been described by *Flick*[12] and later by *Gower*,[13] *Bengston*,[14] and *Tosterud*.[15,16] With the discovery of the importance of proper sealing by *Edwards*,[17,18] sulfuric acid anodic coatings moved to an equivalent position to chromic acid coatings from the standpoint of corrosion resistance, the major exception being parts or assemblies where the acid may be retained and cause subsequent attack. The general operating procedures currently followed are such as to obtain proper control of the essential variables outlined by *Mason* and *Slunder*[19] to achieve satisfactory corrosion resistant films. The two types of baths are usually operated and considered as separate and distinct types. A fruitful source of inquiry might be in the direction of using mixed sulfuric chromic baths, inasmuch as it is possible to postulate improved coatings with less total energy demand. In this connection, it is interesting to note that the *Naval Air Station*, San Diego, still uses mixed baths with complete success and no tank corrosion in spite of the rather adverse report of *Slunder* and *Pray*.[20]

The chromic acid wash process was introduced in the mid-1930's and has been recognized in specifications for many years. The first true conversion type coating used in this country was the hot alkaline chromate dip of *King*,[21,22] now known as the Alrok process. The modified *Bauer-Vogel* process, little used here, is similar. Both of these processes were permitted on naval aircraft as alternates to anodic coatings, except for the exterior surfaces of seaplanes, throughout World War II. With the development of the silicofluoride conversion coatings by *Thompson* and *Ward*[23] and the phosphates by *Thompson*[24] and *Douty* and *Spruance*,[25,26] the need for a specification became apparent and the present MIL-C-5541 is the direct result. Chromate type coatings have also been used for this purpose.[27] Operators interested in applying these processes should consult the pertinent *Qualified Products List* under the specification (QPL5541) for the names of the processes which have already been tested and approved.

Specification AN-QQ-A-696 relies on the salt spray test for proof of acceptable coatings. The validity of this procedure as a test method for these coating has long been under question.[28] In 1943 it was agreed that

Figure 11. Corrosion caused by dissimilar metal contact between counterweight and magnesium wheel.

Figure 12. Severe corrosion of hub of magnesium accelerated by close proximity of steel axle and dissimilar metal contact of bearing race and bearing retainer snap ring. Note, however, absence of corrosion in bearing outer cone seat, which is unfinished. Apparently tight fit prevented access of water.

an attempt would be made to revise the specification to specify quality by thickness or other appropriate means so that testing discrepancies and delays could be avoided. As a matter of practical fact it should be noted that, by the time samples were received by the laboratory, testing completed and reported, the rejected anodic coatings usually had been delivered to the services and incorporated so deeply into an airplane that they could not practically be removed. Accordingly, extensive testing of production anodic coatings to correlate resistance to salt spray with thickness were undertaken at the Naval Air Experimental Station using micrometric and microscopic measurements, voltage breakdown,[29] the Naval Research Laboratory Filmeter,[30,31,32] and the phosphoric-chromic stripping method of *Mason*.[33] For various reasons, primarily simplicity of operation and applicability to surfaces of any shape, the stripping method was chosen and then, to simplify subsequent calculations, it was finally decided to settle on the weight of the coating as the controlling factor. It quickly became apparent that, in the case of 24ST aluminum, which is the test panel required, the heat treatment of the alloy was a critical variable and that weight of coating was a more valid test of quality provided the application details were also properly controlled. Table X shows the weights finally selected for incorporation in a proposed revision to the anodizing specification which will appear in the Military series. It is emphasized that the minimum weights given are for corrosion prevention anodic coatings. When these weights are properly applied to properly heat treated 24ST they will pass the salt spray tests of the obsolete specification.

Magnesium

Coatings for magnesium are currently specified in specification MIL-M-3171. Inasmuch as the process details therein are quite complete they will not be reviewed here. An alternate to the galvanic anodize (Type IV) is the alternating current treatment developed by *Consolidated-Vultee* called Manodyz. At best these give marginal protection (See Figures 6-11-12-13). Recently considerable interest has been expressed

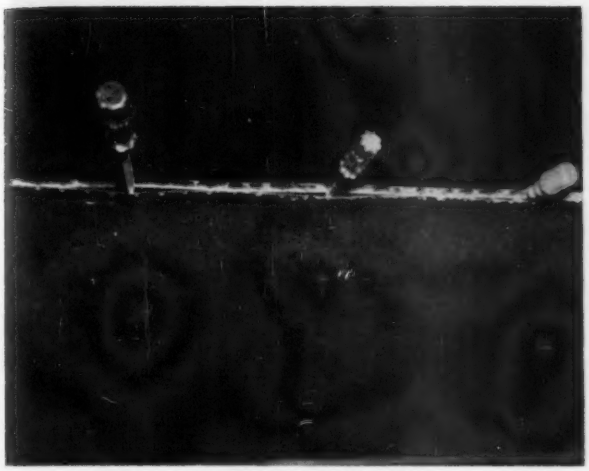


Figure 13. Corrosion at the joint of sheet magnesium and an aluminum alloy extrusion. This corrosion occurred within 48 hours of arrival of airplane aboard an aircraft carrier although the same airplane had operated ashore (primarily in dry climates) for over two years.

in the HAE Treatment developed by *Evangelides* at Frankford Arsenal.[34] So far as is known, this process has not yet been used on an industrial scale although much testing is under way because of the enormous improvement in corrosion resistance as compared to previously used processes.

Sheet flexure fatigue tests on a limited number of samples, as illustrated by Figure 14, indicate approximately 25 percent loss of fatigue resistance, a factor which, coupled with brittleness on the compression side of a bend, places it in serious question when proposed for existing thicknesses of wrought products used on aircraft. Caution should also be expressed at this time concerning corrosion resistance in dissimilar metal couples. The results of coupling bare 14ST with bare HAE coated magnesium using 61S rivets with the rivet holes drilled after treating, are shown in Figure 15. If joints of this type are made for reasons of electrical conductivity or convenience, then the usual painting precautions of the type prescribed by specification MIL-F-7179, should be followed if trouble free service under severe environmental conditions is to be expected. Nevertheless, the corrosion resistance is substantially enhanced an dtests of the

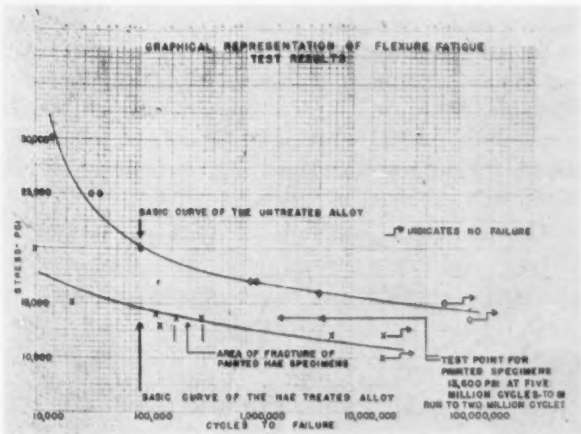


Figure 14. Preliminary sheet flexure fatigue test results on magnesium alloy coated by the HAE process.

applicability of the coating are being pursued vigorously.

Conclusion

This paper has summarized the surface treatments and plated coatings used on naval aircraft metals and has reviewed some of the background information leading to the present specification requirements. While room for improvement always exists, the success of these specifications is reflected in the largely trouble free service being enjoyed by naval aircraft. The fewer maintenance difficulties are encountered, the more time and money can be devoted to the prime function of the Navy — achieving and exploiting control of the sea and the spaces above and below its surface.

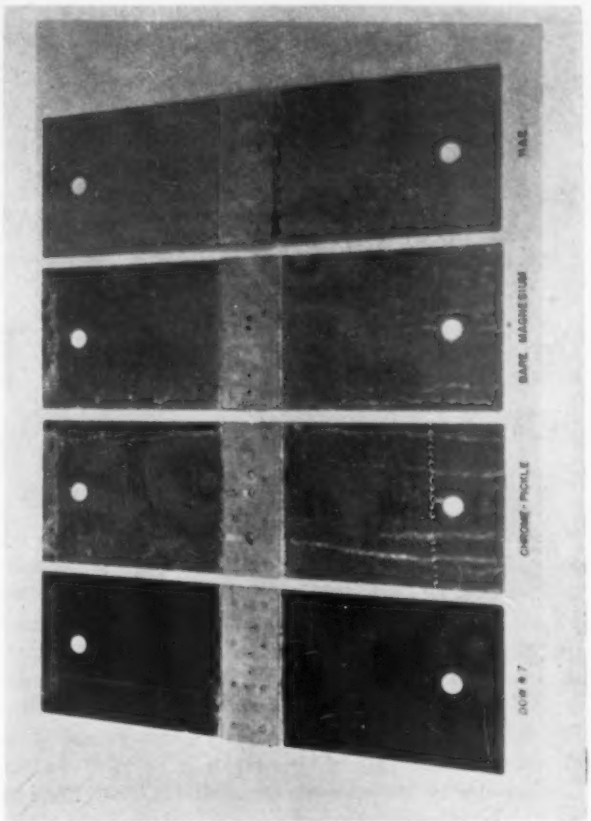


Figure 15. Results of 100 hour salt spray exposure of magnesium panels coupled to aluminum alloy.

Acknowledgement

The writer is indebted to all who have preceded him in this field and particularly to his colleagues, *Messrs. N. E. Promisel, F. P. Somers* and *T. F. Kearns* for general advice and criticism and for specific information on early surface treatments for aluminum and guidance through the unpublished data on porous chromium and cadmium-tin plating.

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(*Concluded on page 73*)

The team on Board the Mauretania during the crossing. Members included J. N. T. Adcock (Leader), Tech. Serv. Mgr., I.C.I. Ltd.; F. A. Champion, Research, Alum. Dev. Ass'n; L. J. C. Connell, Phys., Gen. Elec. Co., Ltd.; M. F. E. Fry, Eng., Jos. Lucas Ltd.; R. A. F. Hammond, Chief, Arm. Res. Est; A. J. D. Lines, Ass't Works Mgr., Lines Bros. Ltd.; V. Long, Sec'y, Trades Union Cong.; E. C. J. Marsh, Ch. Chem., Stand. Tel. & Cables Ltd.; N. A. Tope, Tech. Dir., Montgomery Plating Co.; B. Turner, Chem., Monochrome Ltd.; N. R. Watts, Tech. Serv. Mgr., Gen. & Ind. Paints Ltd.; F. Willets, Ch. Met., W. & T. Avery Ltd.; and G. H. Woodall, Res. Chem., W. Canning Co.

Report of British Metal Finishing Productivity Team on British vs. American Practices

In late 1950 a team of British metal finishing experts were invited by the Anglo-American Council on Productivity (ECA) to visit American plants to get first-hand knowledge of American metal finishing procedures. The overall objective was to determine what American methods, if any, might be adaptable in British metal finishing plants to increase their productivity and efficiency. The following article gives the team's report on this project. Only their conclusions and recommendations are given herein; the complete report is available,* free of charge, and is well worth reading. It reflects the sound judgment and unbiased thinking of Britain's top metal finishing experts.—*Ed.*

IN the U. S. the finishing operation is almost invariably regarded as an integral part of the production line and is planned with the same degree of thoroughness as the press shop or tool room. We did not find any suggestion of the all-too-common idea that "finishing" is a minor but unfortunately unavoidable nuisance. There was a refreshing boldness in planning and a readiness to tear out obsolete plant (equipment) as soon as a watertight case had been made for scrapping it. The well-known American enthusiasm for new ideas probably accounted for the ready manner in which technical staff was concentrated on specific jobs so that difficulties could be overcome with the least possible delay. Generally there seemed a greater appreciation by management of the technical viewpoint, attributable perhaps to the greater proportion of technically knowledgeable people at the higher levels. Technical service by the supply houses also is more highly developed than in this country.

A high degree of mechanization, made possible by specialized finishing lines, was everywhere apparent. Considerable savings in man-power and greater consistency were thus obtained, all with the full cooperation of the operator, who did not seem to fear the arrival of new machines. The American worker, because he is a believer in the profit motive, has no objection to helping his employer to make more money, so long as his own wage packet increases at the same time. All ranks in industry appear to be cost-conscious and a real effort is made by managements to disseminate cost data to all supervisory grades. In some cases the operators were kept aware of certain aspects of departmental costs and of the cost of new equipment provided for them.

The need for a good finish is being put forward to industry and to the general public by a trade association and a considerable sum of money has been set aside for this purpose. A greater realization in both countries of the part played by the finish in prolonging the life as well as contributing to the aesthetic appeal of manufactured articles is certainly long overdue.

It is a deplorable fact that the liaison between

* *Anglo-American Council on Productivity, 2 Park Ave., New York, N. Y.*

design and finishing departments is no better in the U. S. than in this country. Only in rare cases could we find that the finishing department had been consulted at any stage in the design of a product; too often last-minute modifications in design had to be made owing to the sheer impossibility of getting an economical finish.

The condition of the metal surface has a considerable effect on the cost of obtaining an agreed standard of finish. We found that surfaces of zinc-base die-castings and rolled brass strip were better than is usual in Britain and that much wider use was made of high grade bright-rolled sheet steel. It might be said that the surfaces were worthy of a finish of better appearance than they, in fact, received. However, American standards of finish are very different from ours: if an article is not normally subjected to scrutiny at close range, what is called the "curb-side" standard is adopted—as long as the performance does not suffer, minor imperfections and blemishes on the surface are tolerated. It follows therefore, particularly on the plating side, that the amount of work necessary to produce the present standard in the U. S. is relatively small and that even a slight improvement in the appearance of the finish would involve a disproportionate increase in the total effort. Here, in Great Britain, the basis metals require more initial polishing before plating and the extra effort in going from average American to average British quality is a much smaller proportion of the total.

Process control was recognized at all levels from production manager to foreman as a vital part of the manufacturing operation. Inspection in general was careful and realistic; one feature which recommended itself to us was the emphasis placed on inspection in the early stages of manufacture, often by production personnel, which led not only to speedy rectification of defects but also the quick removal of the cause of the trouble. Quality control seems to be firmly established as a valuable adjunct to inspection.

In America, accident prevention and the maintenance of healthy working conditions are on the whole subordinated to the demands of production, though there is evidence of rather greater attention than in Britain to the reduction of operator fatigue in manual operations. There was a considerable interest in British safety regulations and standards.

Polishing and Plating

Reduction of polishing costs by direct and indirect means is a dominating feature of American metal finishing practice. Automatic and semi-automatic polishing machines are used much more extensively than here and this not only reduces the cost of polishing but also eases the labor demand—a factor of particular importance in the U. K., where for some years there has been an acute shortage of polishers. American practice in this respect is of course favored by the large outputs and long runs prevailing in the U. S., which justify the design and manufacture of specialized polishing machinery which, in consequence, is more readily available than here. Also noteworthy is the increasing use of spray polishing compounds which provide a further step towards complete mechanization of the polishing process. For small parts, barrel deburring and barrel polishing are widely used and have reached a high stage of technical development.

Indirect methods of reducing polishing costs are also practised extensively. Thus, a copper undercoat is used on unpolished or partly polished steel components, primarily on account of the greater ease with which copper may be polished as compared with steel; as a further aid to polishing, bright or semi-bright copper solutions are employed on a very large scale, particularly in the motor industry, and these give the added advantage of high rates of deposition. Periodic reverse copper plating is finding increasing favor for the same purpose.

The American approach to the problem of reducing polishing costs is further illustrated by the practice, fairly extensive there, of using pre-polished strip for forming components which are then plated without further polishing. The strip may be polished either by the metal supplier or by the user.

Electro-polishing or chemical bright dipping prior to plating or anodizing are being developed in an attempt to reduce polishing costs. The large-scale application of electro-brightening of steel in association with semi-bright nickel plating and electro-polishing of the nickel for the production of bumpers is an isolated but notable example.

The thoroughness of American cleaning cycles prior to plating and of rinsing facilities was striking. There is no doubt that American practice is superior to average British practice in this respect and it may well be that the relatively trouble-free operation of their large, fully automatic bright nickel installations derives from this fact. A particular instance of some importance is the almost universal use of cleaning and activating cycles interposed between nickel and chromium plating. American practice is probably determined to a large extent by the large outputs normally produced. Thus mass production calls for a high degree of mechanization and this not only demands a high standard of cleaning to minimize rejects but at the same time provides the means of carrying it out consistently and at very little extra cost.

The almost complete replacement in the U. S. of solvent vapor degreasing by alkaline cleaners of various types constitutes a marked difference between British and American plating practice.

The most striking difference in the plating methods in the two countries is the more intensive mechanization in America. The slower progress in mechanization in this country is probably due to the difficulty of justifying the expense of specialized equipment with the smaller outputs prevailing, rather than to any inherent lack of enterprise on the part of British users and equipment manufacturers. Manually-operated plants are rarely used in the U. S. and the automatic machines are often fitted with special devices to suit the requirements of the particular job. The use of such machines not only increases output but favors the maintenance of a more consistent standard of quality, and it is worth considering how far greater specialization in the British plating trade might enable similar methods to be adopted in spite of the smaller overall outputs in this country.

Ingenuity in the use of associated groups of automatic and semi-automatic machines to promote flexibility of production and to economize in equipment and floor space was observed on several occasions; for example, the arrangement of three automatic plating machines to produce alternative thicknesses of copper undercoat for a copper/nickel/chromium finish on different components, and the use of an old automatic machine to serve as a common cleaning unit for a number of different semi-automatic plating processes.

Electro-plating solutions and conditions of operation are in general similar to those here but there are noteworthy exceptions. Thus, bright and semi-bright copper-plating solutions are widely used and dull nickel plating has been almost entirely discarded in favor of the bright processes, and the organic processes in particular. Semi-bright nickel plating followed by light polishing is an established practice. De-ionized water is sometimes used for the preparation and make-up of plating solutions and for rinsing.

Barrel plating equipment and technique are highly developed in the U. S. and it seems likely that the quality of barrel plating is higher and more consistent than the average British standard.

Another interesting feature of American electroplating is the growing use of the periodic reversal process. The value of P.R. plating must be judged in relation to the saving in cost of labor and machinery for mechanical polishing, which promises to be substantial. From this point of view P.R. is potentially valuable as an aid to productivity but the increase in current consumption resulting from the low effective efficiency must be weighed against the power saved in the polishing operation. The cost and difficulty of converting existing plant to the P.R. process must also be borne in mind. The process is being operated with apparent success in a limited number of American plants on a large commercial scale but does not yet seem to have gained general acceptance. Although it possesses attractive features, industrial development is still at a relatively early stage and its commercial future in the field of industrial electro-plating cannot be predicted. The claim that P.R. inorganic cyanide copper has higher corrosion resistance and considerably better physical properties than the conventional high-speed cyanide-plated copper has important implications. If, as is suggested, there are many indoor applications for which chromium direct on P.R. copper affords a satisfactory plating system, the adoption of P.R. copper plating may solve many of the problems presented by the current nickel shortage.

The P.R. process may also be valuable in specialized applications requiring very thick deposits.

In research and development the American plating trade is in certain respects more favorably situated than its British counterpart. The wide scope of the work and publications of the American Society for Testing Materials, the marshalling and co-ordination of forces provided by the Research Scheme of the American Electroplaters' Society and the immediate open publication of the research results have no true parallel in this country. These factors must in the long run prove of great benefit to the American plating industry at large.

Recommendations to the British Metal Finishing Industry

General

1. More attention should be given to the possibility of mechanizing metal finishing operations. Each case must be judged on its merits, and indiscriminate mechanization is not recommended. Specialization as an important aid to mechanization should be considered.

2. Management should make available as many cost data as possible so that the whole organization can be aware of the need for carefully controlling costs.

3. Trade associations should consider a campaign to educate both industry and the public to appreciate the significance of finish and finishing operations.

4. A much closer collaboration between design and finishing departments should be maintained so that the view of the finishing department on the practicability of a proposed design can be ascertained at the earliest possible moment.

5. Consideration should be given to the adoption of the American "curb-side" standard of finish, but this must not be done at the expense of durability.

6. Greater attention should be paid to methods of process and quality control. In some plants inspection might, with advantage, take place at earlier stages of manufacture.

Polishing and Plating

7. Automatic and semi-automatic polishing machines should be installed to increase productivity, reduce costs and counter the shortage of polishers, whenever the nature and quantity of the output justifies their use. General adoption of spray polishing compounds would be premature at this stage but their development should be watched.

8. Pre-polished strip offers economic advantages in some applications and should be used where appropriate.

9. Barrelling processes for deburring and polishing small components should be used more extensively.

10. Semi-bright nickel-plating processes offer the possibility of marked saving in polishing costs as compared with dull nickel, are free from certain of the disadvantages of some fully bright processes, and are worthy of more consideration than they have so far received in this country. They may be of particular value in small plating shops.

11. Electro-polishing or electro-brightening as a substitute for, or ancillary to, mechanical polishing of metals prior to plating, and the chemical bright dipping of aluminum prior to anodizing or plating are potentially valuable processes for reducing polishing costs and increasing output. Many of these processes have not yet reached a stage of development where general adoption could be recommended, but some have proved successful and the subject merits close attention.

12. Metal cleaning and rinsing facilities in many British plating shops are inadequate and should be improved. The American practice of interposing an

(*Concluded on page* 73)

Evaluating Metal Cleaning Efficiency

By **Samuel Spring**, *Research and Development Dept., Pennsylvania Salt Mfg. Co., Philadelphia, Pa.*

THE failure of soiled surfaces to sustain a water film has long been used as a qualitative method of evaluation of the cleanliness of metal surfaces.[1] However, this procedure has not been very successful for obtaining quantitative data. As has been pointed out by the author,[2] the water-break pattern changes continuously as the excess of water drains from partially soiled metal surfaces, while evaporation of the water from the clean areas becomes an important factor by the time a fairly constant pattern is obtained, after drainage of the excess water.

In an effort to compensate for these difficulties, a procedure was developed in which a mist or fine spray of water is directed against the metal surface to be evaluated. This mist collects on the soiled areas in fine droplets which do not coalesce readily and which yield a sharply delineated soiled area pattern. This is called the water spray pattern method. The pattern remains unchanged for a reasonably long period of time, e.g. 20 minutes, during which time it is possible to sketch the pattern to make a quantitative estimate.

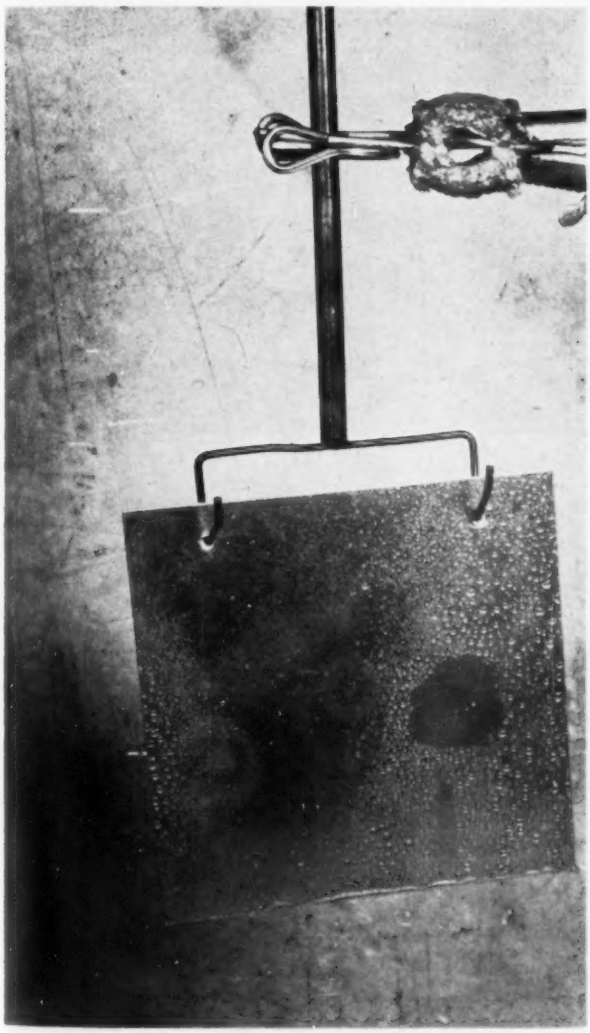


Figure 1. Representative soiled panels as delineated by the water spray method.

In order to obtain quantitative data, the soiled area pattern is sketched on graph paper having 100 squares, and the sum of the clean areas is taken as per cent cleaning. In Figures 1 and 2 are shown a representative soiled area pattern and the corresponding sketch.

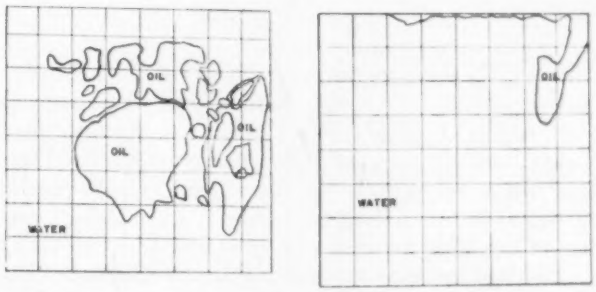


Figure 2. Sketch of soiled area patterns showing two typical cleaning efficiency conditions.

While this procedure is satisfactory and offers the advantage of a permanent record, it has been found far more convenient to use a viewing box designed and constructed by *Dr. Panepinto* and *Mr. H. R. Miller*, of the *Pennsylvania Salt Mfg. Co.'s* Research and Development Div.

This box is made of clear plastic and on each side of the box are ruled 100 squares in an area equal to the size of the metal panels used. Between the two sides, as shown by Figure 3, is a slot into which the metal panel fits so as to be in register with the ruled squares. The spray pattern is traced with a wax pencil. The clean areas are summed as before and the value is recorded for each side of the panel, following which the sketch is erased. While this does not give a permanent record it offers the convenience of more rapid and accurate sketching, that is of considerable assistance because of the number of panels that must be used for each value of Cleaning Index.

Because of the heterogenous nature of most metal surfaces and the variables involved in the cleaning process, the values obtained for per cent cleaned area of both sides of five panels, (a total of 160 square inches) are averaged to give the Cleaning Index. This was determined by a limited statistical study under the

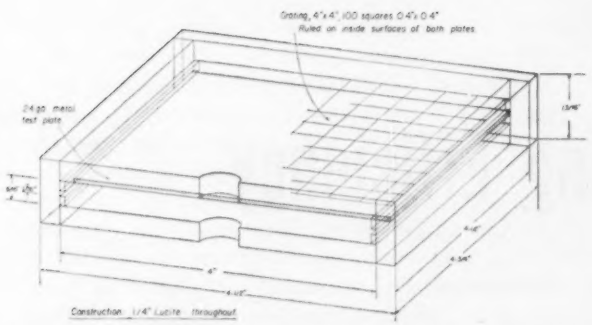


Figure 3. Construction of viewing box for estimating soiled areas. Shaded area indicates location where steel test panel is inserted.

particular conditions under which we were working. For any other experimental set-up, of course, a statistical survey should be made to determine the total area that must be processed in order to make an accurate evaluation after a cleaning operation.

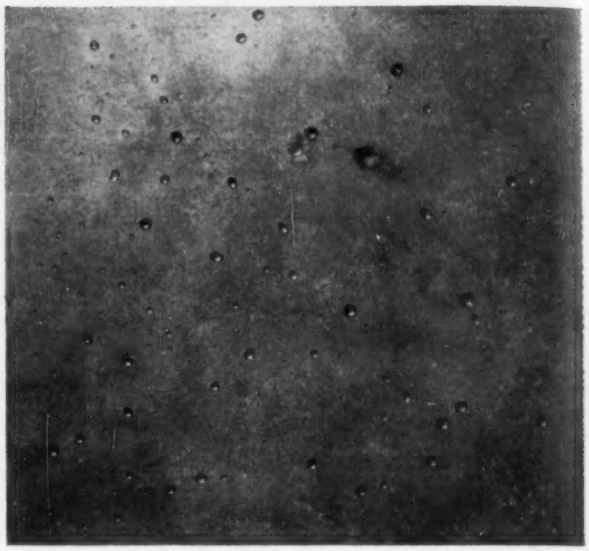
As an example of the many pitfalls encountered in detergency tests and their evaluation, we may cite a recent experience with the test which utilizes the spray pattern method of evaluation as published in 1946.[1] In setting up the test with new personnel it was found that reproducible results were not obtained. After some investigation it was found that after the preparation of the panels, which involves cleaning and pickling operations, followed by water and hot ammonaical alcohol rinses, a minimum storage period of about 24 hours in an evacuated desiccator was required in order to obtain uniform results with pickled steel panels. In previous experiments, conditions were such that panels were never used before the minimum storage period had elapsed. On the other hand, this effect was not observed with unpickled panels. After storage for a considerable time in an unevacuated desiccator, results were similar to those obtained with unpickled panels. It would appear that some time is required to obtain an oxide coating of minimum thickness in order to produce a uniform condition. These effects are illustrated in Table I.

While the point just discussed relates more to detergency testing than to soiled surface evaluation, there is sufficient pertinence to the subject matter under discussion to digress a bit further in this direction.

In the metal cleaning evaluation procedure referred to above, panels were covered with oil by immersion and drainage for one hour at room temperature. As has been pointed out,[3] the amount of oil on the panels and the degree of cleaning by a specific cleaner is dependent upon the viscosity of the oil. Since viscosity is a function of temperature it is not surprising that the weight of oil and the degree of cleaning is a function of the temperature at which drainage of the oil takes place. In Table II, some data are given for the effect of drainage temperature. It may be seen that the effect is not great for a variation in temperature of from 22° to 25°C. but changing the temperature between wider limits causes a substantial change in results. It seems that this was not sufficiently emphasized in previous publications.

Returning to the evaluation of soiled areas on metal surfaces, the spray pattern method, and for that matter,

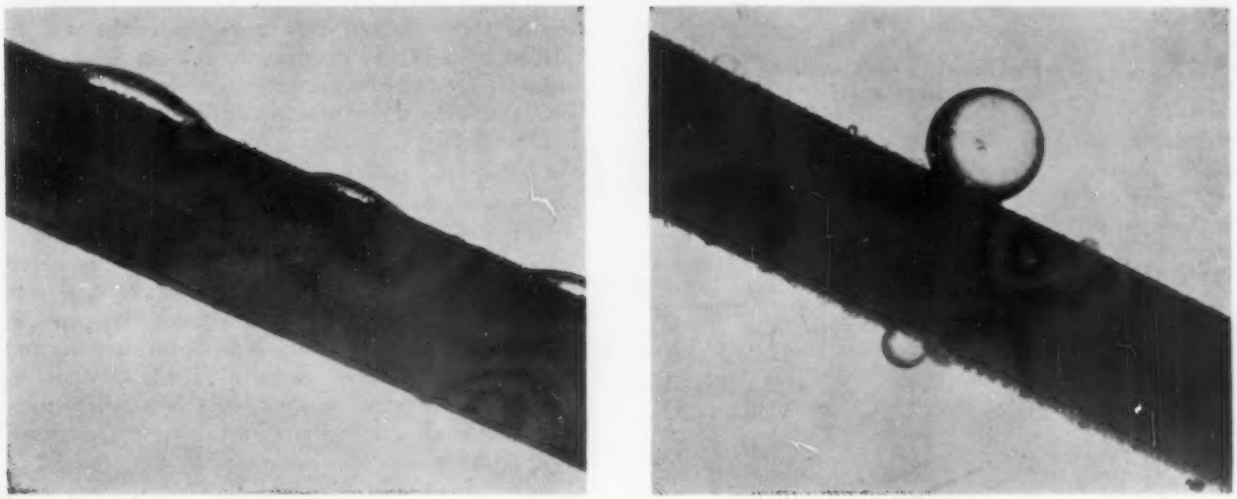
Figure 4. Stages in the removal of oil from a metal surface: (A) Shrinkage of oil film and appearance of discontinuities; (B) Formation of flattened globules; (C) Formation of rounded globules.



(A)

(B)

(C)



(A) (B)

Figure 5. Profile view of shrinkage and globule formation: (A) Beginning of globule formation; (B) End of globule formation.

the water break method are relatively sensitive tests. If the total soil on a surface were distributed in a uniform film, very little soil indeed would be required to indicate a completely soiled surface. This is very evident when panels that have been cleaned with emulsion cleaners or vapor degreasers are examined. Although no visible soil remains, both the water break and spray pattern tests indicate completely soiled panels. However, observations of the removal of soil from metal panels indicate that oils, at least, are removed by alkaline cleaners just about completely from certain areas, leaving other areas covered with substantial quantities of oil. Therefore, these tests are valid in evaluating residual soil from cleaning operations within certain limits. These limits are readily observable with the unaided eye; thus it is possible to determine whether there is a small or large amount of soil on a piece of metal.

The above may be demonstrated by a few photographs illustrating the process of oil removal.[4] In Figures 4 and 5 are shown stages of the removal of oil from a metal surface. It may be seen that the oil film, which is initially continuous, shrinks and yields many discontinuities in which no oil is evident. Those areas that are still covered with oil, however, have thicker films than originally. Finally, the oil assumes a spherical form with minimum attachment and is then removed.

The water spray pattern apparently discloses the area from which the oil has been removed either

Table I

Effect of Time of Storage in an Evacuated Desiccator on Cleaning of Steel

(Data presented through courtesy of Miss Louise F. Peale, Frankford Arsenal Laboratories)

Oil	*Surface Pickled*	*Storage Time*	*Cleaning Index*	*Stand. Dev.*
Cleaner — 1.5% sodium orthosilicate + 0.15% alkyl aryl sulfonate				
Mineral	1 min. 5% HCl	None	0	0
Mineral	1 min. 5% HCl	Overnight	25%	5
Mineral	1 min. 5% HCl	24 hours	38%	5
Mineral	1 min. 5% HCl	3 days	41%	4
Mineral	1 min. 5% HCl	1 week	50%	4
Mineral	1 min. 5% HCl	3 weeks	45%	4
Mineral + 10% oleic acid	1 min. 5% HCl	None	20%	7
Mineral + 10% oleic acid	1 min. 5% HCl	Overnight	91%	5
Mineral + 10% oleic acid	1 min. 5% HCl	1 week	92%	4
Mineral	No acid pickle	None	90%	4
Mineral	No acid pickle	24 hours	89%	3
Mineral	No acid pickle	1 week	90%	3
Cleaner — 1.5% sodium orthosilicate + 0.15% sodium resinate				
Mineral + 10% oleic acid	1 min. 5% HCl	None	28%	7
Mineral + 10% oleic acid	1 min. 5% HCl	Overnight	87%	5
Mineral + 10% oleic acid	1 min. 5% HCl	1 week	87%	3
Cleaner — 1.5% sodium orthosilicate + 0.15% soda soap				
Mineral + 10% oleic acid	1 min. 5% HCl	None	Scattered	—
			13-48%	4
Mineral + 10% oleic acid	1 min. 5% HCl	Overnight	83%	4
Mineral + 10% oleic acid	1 min. 5% HCl	1 week	83%	

Table II

Effect of Drainage Temperature on Cleaning Index

(Data presented through courtesy of Miss Louise F. Peale, Frankford Arsenal Laboratories)

Mineral Oil Viscosity Sec./100° F. S.U.V.	*Drain. Temp.*	*Wt. of Oil Per Panel*	*Cleaning Index*	*Stand. Dev.*
283	22°C.	0.276 gram	91%	8
283	25	0.252	91%	6
283	35	0.159	100%	0
472	22	0.287	52%	6
472	25	0.288	56%	6
472	30	0.221	64%	3
472	35	0.206	72%	9

temporarily by a shrinkage or permanently by physical removal.

It is evident from these considerations that water break tests offer greatest application with surfaces from which the bulk of the soil has been removed and probably in cases in which the soil is mainly oily in character, although this does not necessarily exclude cases which there are solid soils dispersed in oil media. For other types of residual soil, methods which will be described elsewhere on this program are probably more advantageous. Visual inspection should readily show when these methods are inapplicable.

For many applications, the usefulness of a cleaning procedure is determined by the ability to give complete soil removal and the usefulness of a comparative cleaning test is greatest under conditions approaching this 100% cleaning. This is especially true for cleaning prior to electroplating. On this basis, it is believed that this method of evaluation, which is more sensitive and useful in this range, offers the greatest possibilities. It might also be mentioned that the use of the water spray pattern method in a program of research on factors in metal cleaning has given consistent, interesting and useful results.[3,5]

It is well known that the presence of surface active agent will cause a water film to bridge-over oil covered areas. A customary procedure for reducing this effect has been to immerse the panels in dilute acid for a short time, prior to final rinsing. In a short investigation on this bridging effect, it was found that this was at a minimum with well agitated, warm water (50°C.) rinsing prior to the spray pattern evaluation. Thus, it was observed that panels rinsed with running warm water for three minutes, from which they were removed at least once each minute, gave the same values for cleaned areas whether they were dipped in acid or not, using alkaline cleaners containing both fatty acid soap or organic synthetic detergents. Steel that had been dipped in acid, however, tended to rust during the final evaluation.

Another recent observation may explain certain discrepancies in the results obtained with the spray pattern and water-break tests. After a cleaning test, sometimes there are a few very fine globules of oil floating on the final rinse water. Frequently these are picked up by the metal. Even though the panel is indicated as being clean by both spray pattern and water-break tests, some globules of this oil may be present on the surface in a very loosely adherent form since they readily float about on the water film. However, if the panels are permitted to dry, the oil is deposited on the metal surface which is then indicated as being soiled by the water-break type test. On the basis of the above, panels should be observed very carefully after the final rinse to determine whether or not any surface oil is being picked up and allowed to dry on the metal surface. A final flush rinse readily removes this oil and would be desirable.

In summary:

1. The water spray pattern offers a useful procedure for the evaluation of partially soiled surfaces. especially as a laboratory evaluative method, although it is adaptable to plant usage.

2. Several suggestions are made to make alkaline metal cleaner evaluation by this method more precise and convenient.

3. The scope of applicability of the water spray pattern and water break test can frequently be determined by visual inspection and this should not be neglected. Thus, it would be wrong to apply this test to very heavily soiled or hydrophobic surfaces.

4. Certain precautions should be used in applying these tests; some of these are:

a) Uniform metal surfaces should be used for laboratory tests.

b) Care should be taken to rinse off last traces of surface-active agent.

c) Loosely adherent oil picked up from the surface of rinse water should not be permitted to dry onto the metal.

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Heavy Immersion Tin Plating

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Exceptionally dense and adherent tin coatings can be formed on most metals, including cast iron, many alloy steels, brass and copper, by simple immersion in contact with aluminum in the hot stannate solution normally used for electroplating. Deposition does not cease when the base metal is covered and fairly thick deposits can be built up in a reasonable time. The process, which is equally suitable for large and small parts, is capable of tinning awkward shapes and recesses that cannot easily be coated by electrodeposition; electrotinning of significant surfaces and contact tinning of recesses can proceed simultaneously. Contact tinning may also be of value as an undercoat, for example, in the electroplating of cast iron, in the prevention of fretting corrosion of contacting surfaces, and for the protection of springs and of aircraft radiators and oil coolers.

THE rediscovery and development of forgotton processes often affords as much satisfaction as the original discovery, especially when, as in this case, the development solves an awkward problem.

The art of coating or plating one metal with another by immersion in a suitable solution has been known and practiced for over a hundred years. The similar art of "contact plating," which permits a metal whose properties would not initiate this coating, to be plated by being immersed in the solution in contact with another metal, though not quite so old, was none the less practiced early in the last century. Contact plating has mainly been associated with "tinning" and has normally been used only for small articles or an occasional emergency. Fundamentally, the present discovery is this: the use of a light alloy and a normal tin plating bath permits the processing of quite large components; indeed jobs up to 18 feet long have been processed and coatings up to 0.002 in. thick have been achieved with comparative ease.

When one considers the possibilities of contact and immersion plating, it is rather surprising how little has been published on the subject in recent years. There has been work published by *Brenner*[1] on the immersion plating of nickel, cobalt and nickel-cobalt; a patent of *Morris Motors Ltd.*[2] for immersion tinning the inside of radiators for I.C. engines; and various immersion processes for the immersion tinning or zinc plating of aluminium as a preliminary to normal nickel or chromium plating.

Contact tin processes are, generally speaking, slow, and are only used for small articles. Although the Tin Research Institute has a list of solutions and methods for contact tinplating,[3] it would appear that as the publication is only mimeographed, the demand is small.

The authors believe that the most commonly used process is that attributed to *Gerhold*, namely the stannous chloride—cream of tartar solution with granulated zinc or perforated zinc foil as the contact metal, used for the tinning of pins, etc. It has been stated[4] that the function of the cream of tartar in this solution (and the non-tin salts in other solutions) is to prevent hydrolysis and precipitation of stannous oxide, and also that a cell is created between the zinc and the basis metal so that the action stops when the basis metal is completely covered.

Although the coating is thin, it is extremely fine grained and the evidence is that it is more protective than a similar thickness of tin applied electrolytically. Also, by virtue of its operation, it would appear that no shape would be too involved to secure a complete coating. Quite apart from this, *Dr. Wernick* has explained[5] how a thin undercoat of tin gives added protection to other electro-deposited coatings as well as promoting better distribution.

Problems and Subsequent Developments

During World War II the authors had to face the problem of protecting the inside of a copper centrifuge shaped somewhat like a horseshoe. It was beyond our ingenuity to design a central anode in order to electrotin this part. A close study of the better-known contact processes was made although it was considered that any coating applied by contact plating would not withstand the scouring action of hot coolant at high speeds. From observations it was found possible to get a coating from our normal stannate plating bath using a light alloy contact. Experiments uncovered the way and moreover showed that a *progressive* coating could be applied: in other words, the action and tin deposition continued after a complete covering had been achieved, using the conventional sodium stannate-caustic soda solution at 65-75°C. This centrifuge withstood two years intermittent flying with varying coolants and suffered very little deterioration.

As an example of this progressive coating, four similar test pieces of mild steel were cleaned, dried and weighed. Three test pieces were given similar contacts, one being left without contact. They were immersed

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together, but not touching, in a beaker of plating solution taken from the works routine plating bath. The three pieces with the contact metal were removed at 20, 40, and 80 minute intervals respectively, washed, dried and reweighed. They were then replaced in the solution and the experiment repeated.

In all cases the increase was in very close ratio to the time of immersion. Calculations showed that deposition was at the rate of approximately 0.0002 in. per hour. The test piece without contact was unchanged after 160 minutes.

Experiments were continued and a more interesting point was discovered, namely, that contact plating could be carried out on parts of components which would normally require auxiliary anodes plus the fact that it could be done during the normal plating of the rest of the component. As an illustration, we have to tin plate a component which is essentially a steel tube. One zone has a thicker wall than the rest and through this thicker section there are several ¼ in. holes about 4 in. long and parallel to the length of the tube. These are tinned all over, the holes being tinned by the contact process during the electrotinning operation of the remaining surface. One of these components given a 2,000 hour test by circulation of hot distilled water showed no sign of corrosion and the water had absorbed no metals. All other parts of the circulating system were tinned, some by this process, others electrolytically. A similar component treated in like manner successfully withstood a nitriding cycle.

The process is much quicker than standard contact processes, and a steel tube 8 in. long with a $\frac{1}{16}$ in. bore was coated inside and outside after 20 minutes in the solution with only a thin wire of light alloy placed in the bore. As far as the aluminium wire is concerned, the action is sacrificial. The aluminum dissolves in the sodium stannate, releasing the tin for coating. Sodium aluminate is formed which then hydrolyses out to aluminium hydrate and falls to the bottom of the tank in the form of sludge, together with a certain amount of tin. The sludge can be scooped out and the tin reclaimed with caustic soda.

Metals which have been tinned include alloy steels up to the heat-resisting austenitic qualities, brass, copper and cast irons. One cast iron component is successfully electro-tinned after being given a preliminary coat by this contact process, although indifferent tinning resulted from the normal procedure.

A tank, 6 ft. long, 4 ft. diameter with several flanged inlets and outlets was successfully tinned by the dual process after efforts to electro-tin with internal anodes had left several bare patches in the inlet pipes.

Pipes up to 18 ft. long have been tinned by using a plait of wire as a contact. The pipes, several of which have side branches, are sealed to leave one end open. The wire is inserted in the open end and the pipes filled with hot solution from the tin plating bath. They are usually left overnight, the solution being returned to the bath. Pipes treated in this manner have been in continuous service with circulating hot water or hot oil for nearly two years and are still 100% coated.

Adhesion, Contamination and Fret

The bond of this coating is exceptionally good. Heat resisting steel test pieces, trichlorethylene degreased and tinned by this process have been soldered and then pulled apart. The rupture has always occurred in the solder and not in the pure tin coating.

As an illustration of "throwing power," a coil of copper foil was tinned for 20 minutes using a piece of wire in the centre of the coil. A complete covering was obtained, although where the surfaces were touching it was obvious that the coating was thinner than elsewhere.

When applied in the plating bath itself, there is only slight contamination of the solution as the light alloy salts hydrolyze out, and tests have shown no contamination of the tin coating.

For a considerable period we have in most instances successfully overcome failures resulting from fretting corrosion on high duty engine components by applying an electrolytically deposited coating of tin to one of the two mating faces liable to become a victim of fretting. The depth of the deposit is somewhat critical and has been found most beneficial between 0.0005 and 0.001 in. thick.[6]

Coatings deposited by the contact processes, however, are more dense than those produced electrolytically and therefore it would seem reasonable to conclude that an anti-fret film deposited by contact plating will prove even more efficient than one deposited electrolytically. Work is at present proceeding along these lines with a view to making comparative tests in the anti-fret properties of contact-tin and electro-tin coatings and the subsequent use of intricate designs.

Conclusions

From these disclosures we are of the opinion that many problems can be solved using a thick coating as a protection or a thin film as undercoat for electroplating other metals. Contact plating, for instance, can be successfully employed for the purposes of tinning bearing shells prior to casting on white metal bearing alloys. Various springs have been tinned both as a protective measure and for subsequent lead plating and we think that aircraft radiators and oil coolers would be satisfactorily tinned by this process.

Although most of our production work has been carried out with the sodium stannate-caustic soda plating bath, the light alloy contact will give a progressive coating from the stannous chloride-cream of tartar bath and coatings have also been obtained from other tin baths including the fluoborate. Best results, however, have been obtained with the stannate bath.

The authors are indebted to the Directors of Messrs. D. Napier and Son Ltd., Acton, W.3, for permission to publish.

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The Perchloric-Formic Acid Method for Gold

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The Author

The perchloric-formic acid procedure may be used for gold-copper alloys and for potassium gold cyanide. Interfering elements are listed.—*Ed.*

Introduction

ANALYTICALLY, the usefulness of the perchloric-formic acid method for the determination of gold in certain alloys and in cyanide has not been favorably described.[1] A formic acid reduction method for gold was first outlined by *Mylius* and *Dietz*[2] and was later used by *Noyes* and *Bray*[3] in qualitative analytical separations. In this paper, the additions and changes in the *Noyes* and *Bray* technique necessary for quantitative use are presented.

Precautions in Handling These Acids

Perchloric acid, at its boiling point (204°C.) is an active oxidizing agent; on the other hand perchloric acid solutions which contain water, or anhydrous perchloric acid which is maintained at temperatures of less than 200°C. are only selective oxidants. For example, a 4 N perchloric acid-cerate solution will quantitatively oxidize glycerol[5,6] to a stable end product — formic acid. Thus, it is to be expected that a mixture of perchloric acid and the reagent formic acid (87-97%, balance water) will not explosively react at 100°C. The boiling point of formic acid is 100.7°C.

Formic acid rapidly reacts with hot (1:1) nitric acid, but in more dilute nitric acid solution its action is slow, so that dilute aqueous solutions of nitric and formic acids may be freely heated.

Procedure for Gold-Copper Alloys

Size of Sample

The test sample should weigh not more than one gram and should contain from 20 to 200 mg. of gold; for high gold alloys a sample size of 0.1 to 0.3 gram is convenient.

Precipitation of Gold

Weigh the sample to the nearest 0.1 mg. and transfer it to a 200-ml. beaker or Erlenmeyer flask. Add 5 ml. of hydrochloric acid and 5 ml. of nitric acid. Mix. Cover and warm the beaker on a hot plate (60-80°C.) until the alloy has disintegrated. Add 10 ml. of perchloric acid, 70 per cent, for a 0.5 gram sample, or 12 ml. for a larger sample. Continue heating to volatilize the lower boiling acids, then increase the heat so that the perchloric acid condenses half-way up the beaker. Maintain at this temperature for 5 minutes. This treatment minimizes loss of gold by volatilization. If gold is present, the beaker will contain a black precipitate of gold.

Cool the beaker to room temperature or below room temperature. Add 5 ml. of formic acid, sp. g. 1.20, and mix. Set the beaker on a steam bath, or preferably place the 150-ml. beaker in a slightly larger beaker containing water. In this manner the temperature of the reaction beaker will not exceed 100°C. At about 80°C. the remainder of the gold will be reduced to the metallic state. After the physical change is noted and the supernatant liquid clears, continue the heating for several minutes. The beaker should not be unattended for any period of time.

Remove the beaker from the heat, add 10 ml. of water and just one drop of nitric acid. Again, warm gently (60-80°C.) for about one minute. Stir the mixture in the beaker for several minutes to better coagulate the gold and remove adhering impurities. Let settle.

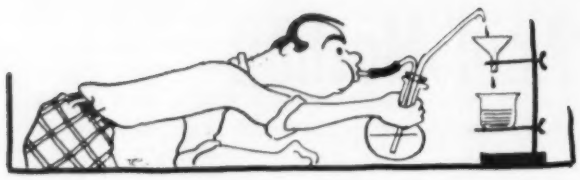
Gold Determination

Carefully decant the supernatant liquid through a weighed Gooch crucible held in a filtering bell-jar, into a 400-ml. beaker. Add 10 ml. of (1:1) nitric acid to the gold residue in the beaker, heat just to boiling, cool and decant as before. Repeat the nitric acid extraction once more. Transfer the precipitate to the Gooch crucible with a stream of hot water. Policing is usually unnecessary. Wash well.

Dry the crucible in the oven, then ignite over an open Fisher burner. (Gold melts at 1063°C.) Cool and weigh. The increase in weight is metallic gold.

Copper Determination

Evaporate the filtrate to half-volume, then cool. Make the solution alkaline with ammonium hydroxide, acidify with sulfuric acid and add 4 ml. of (1:1) sulfuric acid in excess (per 100 ml. of solution). Electrolyze for



copper (and lead), as usual, adding a little sulfamic acid[4] toward the end of the plating time.

Procedure for Potassium Gold Cyanide

SIZE OF SAMPLE

About 0.2 gram of the solid (40-60% Au) is sufficient.

Dry, cool and weigh a tight-fitting weighing bottle. With a horn spoon, transfer about 0.2 gram to the weighing bottle, cover and reweigh. The gain in weight is the weight of the sample.

Transfer the sample to a 150-ml. beaker, using a minimum amount of water. Add 10 ml. of nitric acid (sp. g. 1.4) and 10 ml. perchloric acid, 70 per cent. Heat at 60-80°C. to volatilize the nitric acid, then increase the heat so that the perchloric acid condenses half-way up the beaker. Complete as for gold in the procedure for pure gold-copper alloys.

Potassium perchlorate does not interfere. It is removed by the acid-leach, and may be recovered and determined as potassium perchlorate.

Table 1

Analyses of Gold and Gold-Copper Alloys

Total Wt. Sample Taken (gm)		*Wt. Metal* Taken (gm)*	*Wt. Metal Found (gm)*	*Recovered Per Cent*	*Analyst*
	(Copper	0.1694	0.1693	99.94%	
0.3287	(Gold	0.1593	0.1592	99.94%	(1)
	(Copper	0.2494	0.2463	98.76%	
0.3800	(Gold	0.1306	0.1306	100.00%	(1)
	(Copper	0.2427	0.2423	99.84%	
0.3746	(Gold	0.1319	0.1318	99.92%	(1)
0.2192	(Gold	0.2192	0.2183	99.59%	(2)
	(Copper	0.5217	0.5179	99.27%	
1.04223	(Gold	0.5206	0.5201	99.90%	(3)
	(Copper	Test		50.2%†	
0.2096	(Gold	sample		49.8%	(4)
	(Copper	Test		24.0, 24.2%‡	
	(Gold	sample		75.5, 75.4%	(4)

Notes

*Known from metal percentages taken to prepare alloys, or from direct weighing.
†Mfg. sample of 50-50 Au-Cu alloy.
‡Mfg. sample 75.6% Au, 24.4% Cu.

Discussion

The perchloric-formic acid technique compares favorably with that of other gravimetric methods. These usually are performed in hydrochloric acid solution after several evaporations to remove excess oxidant, while perchloric acid requires only one fuming operation. The hydroquinone reduction method[1], however, has the particular advantage that gold is separated from the platinum metals by simple reduction; while formic acid precipitates gold, mercury, platinum, palladium, and some iridium and rhodium. Further, perchloric-formic acid precipitates the oxides of columbium, tantalum, antimony, tin, tungsten, titanium and molybdenum. In the presence of these elements it is advisable to extract gold chloride with ethyl acetate, evaporate the extract, then proceed as for gold in potassium gold chloride.

The evaluation of gold in potassium gold cyanide is desirable since the gold content should be known before preparing gold electroplating solutions. The compound K Au $(Cn)_2 \cdot 2H_2O$ should be 60 per cent in gold, but in one sample only 40 per cent was found. The presence of potassium perchlorate caused no difficulties in this procedure.

The procedure may be applied to the analysis of cyanide gold plating baths, from which test samples containing as little as 2 mg. of gold are adequate.

The (1:1) nitric acid purification treatment is used to remove adhering elements such as copper. If, for certain impurities, it is desired to use an additional hydrochloric acid leach, then the nitric acid must be completely washed out with water. An ammonium hydroxide wash may be used to dissolve residual silver chloride.

The metallic gold may be recovered by dissolving the metal in aqua regia.

Colorimetric Determination of Gold & Copper for Small Samples (1-10 mg.)

Transfer the sample to a 50-ml beaker and add 3 ml each of conc. nitric and hydrochloric acids. Warm to complete solution of the sample and evaporate to half-volume. Add 5 ml. of perchloric acid and heat until heavy fumes of perchloric acid appear. Cool. Add 5 ml. of formic acid (85%) and heat on the steam bath for 5-15 minutes (1 mg. of precipitated gold is easily visible), shaking to aid coagulation. Cool. Add 15 ml. of water and stir well to complete the gold coagulation.

GOLD

Filter through a No. 40, 9 cm. Whatman paper, wash several times with (1:10) nitric acid, then water and once with 5% ammonium nitrate. (Reserve the filtrate for copper.) Transfer the paper and contents to a porcelain crucible, set the crucible over an asbestos-center wire gauze and heat with a Fisher burner (about 400° C.). Finally, complete the burning of the paper in a furnace at about 500°C. (550°C. is the maximum temperature permissible, else the gold metal may fuse into the porcelain.) Cool. To the crucible add 2 ml. of hydrochloric acid, 1 ml. of nitric acid and 0.1 g. of sodium chloride. Evaporate the solution almost to dryness on a steam-bath, then add 3 ml. of hydrochloric acid and evaporate to about 1 ml. volume. Cool. Add 5 ml. of (1:4) hydrobromic acid (48%) to take up the sodium chloraurate and warm. Transfer the solution to a volumetric flask (usually 25 ml. size) and dilute to volume with (1:4) hydrobromic acid. Read on the 425 mμ (blue) filter, using water for the 100% setting.

COPPER

To the filtrate reserved for copper determination add 10 ml. of nitric acid and evaporate to about 15—20 ml. Cool. Add 2 g. of citric acid and mix to dissolve

the solid. Add ammonium hydroxide until the solution is blue or alkaline to litmus paper. (Depending on the intensity of color, the sample may be transferred to a 25-50-or 100-ml. volumetric flask. The 50-ml. volumetric flask is for the range of 1 to 10 mg. of copper.) Transfer the solution to the selected volumetric flask and add first, ammonium hydroxide so that the flask will contain 20 ml. of ammonium hydroxide per 50 ml. of final volume, and dilute to the mark with water. Read on the 625 mμ (red) filter.

GOLD STANDARD SOLUTIONS

Accurately weigh a sample of gold (5-10 mg.), transfer to a 50 ml. beaker and dissolve in 5 ml. of hydrochloric acid and 2 ml. of nitric acid. Add 0.1 g. of salt and evaporate to near dryness on a water bath. Add 5 ml. of hydrochloric acid and evaporate to about 1 ml. volume, to eliminate oxidizing agents. Cool. Transfer to a volumetric flask of size such that 1 ml. will contain 0.01 mg. of gold. Dilute to volume with (1:4) hydrobromic acid.

Prepare a series of 25 ml. volumetric flasks, and add known amounts of Gold standard solutions in the range of .01—0.20 mg. gold. Dilute to volume with (1:4) hydrobromic acid and mix well. Use water as the 100% setting and read the series using the 425 mμ (blue) filter. A straight line graph will be obtained.

COPPER STANDARD SOLUTIONS

Transfer 1.000 g. of pure copper to a 250-ml. beaker. Dissolve the sample in 25 ml. of (1:1) nitric acid and warm to drive out the brown fumes. Cool. Transfer to a 1-liter volumetric flask and dilute to volume with water. Mix well. 1 ml. contains 1.00 mg. of copper.

Prepare a series of 50 ml. volumetric flasks and add 1.0—12 mg. of copper. Add to each 2 g. of citric acid and then add ammonium hydroxide until the solution turns blue. Add also 20 ml. in excess of ammonium hydroxide. Dilute to volume with water. Mix well. Use water as the 100% setting and read the series using the 625 mμ (red) filter. A straight line graph will be obtained for the 1 to 10 mg. copper plot.

Acknowledgments

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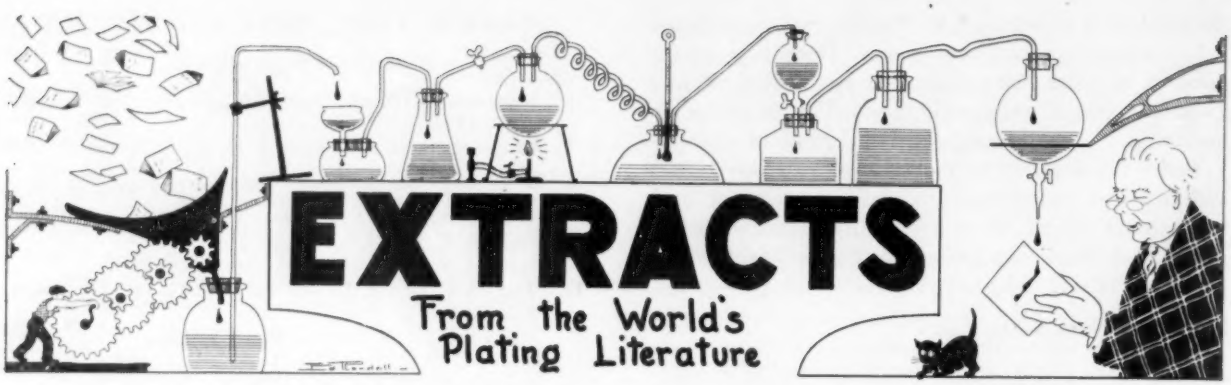
alkaline cleaning, rinsing and activating cycle between bright nickel and chromium plating is worth investigation.

13. Plating and rinsing troubles are frequently traceable to an unsuitable water supply. In such cases the use of de-ionized water should be considered.

14. The layout of plating shops should be reviewed to see whether improvements in flexibility and economy of production can be gained by adopting the simple though unorthodox combinations of machines noted in America.

15. Although the general adoption of P.R. plating on a large scale at this stage would be premature, the process offers important advantages and its development should be closely watched.

16. The appropriate authorities should explore the desirability and practicability of instituting a co-ordinated electro-deposition research scheme with immediate open publication of results on the lines of the scheme operated by the American Electroplaters' Society.



Influence of Foreign Bodies and Hydrogen on the Properties of Electro-Deposited Metals

E. Raub; *Paper Read to Meeting of the Deutschen Gesellschaft Metallkunde (German Metals Society) at Stuttgart, April, 1951.*

Electrodeposited metals owe their properties, which very often greatly deviate from melted and recrystallized metals, to the simultaneous co-deposition of non-metallic foreign bodies which are imbedded in a highly dispersed form in the metal lattice structure and consequently give rise to strong lattice disturbances. Formerly special significance was given to the effect of hydrogen on the properties of the deposited metal. On the other hand today relatively less influence is ascribed to hydrogen in this way, the reason for this change in viewpoint being that it can be proved with various electrodeposited metals that the hydrogen absorbed by the metal during the electrolysis can be driven off again, without the properties of the electrolytic deposited metal changing. On the other hand the destruction or dispersel of other highly dispersed occluded foreign bodies of organic or inorganic compounds is always associated with an almost sudden characteristic change in the properties of the deposit metal.

Detailed research investigation on nickel baths of a chloride or sulphat formulation basis have shown that the hydrogen can act very differently on the properties of the nickel deposite metal and that its influence is not always to be ignored. With deposition bath temperatures of 20° and 40°C. a solution of hydrogen in nickel is observed with a broadening of the lattice structure under certain working conditions only with nickel from pure chloride baths or nickel baths rich in chloride and not in similar cases from baths rich in sulfate. With high nickel bath temperatures (80° to 100°C. — also from the chloride nickel baths metals deposits have also been confirmed which do not show the broadened nickel lattice structure.

The different behaviors of the chloride and sulfate nickel baths find an explanation in the fact that from the chloride baths the nickel separates at a nobler potential than from the nickel sulfate bath. The potentials of the hydrogen and of the nickel deposition in the chloride bath lie nearer to one another. For the solubility of the hydrogen in the solid nickel one consequently observes the same connections between the course of the cathode potential-current density curves and the mixed crystal formation in the separated alloy as is found with the simultaneous discharges of two metals. The hydrogen dissolved by means of the broadening of the lattice in addition does not influence the properties of the nickel metal in a very clear manner. On the other hand under certain circumstances molecular hydrogen can be occluded in the nickel crystallites with strong lattice disturbance without causing any perceptible lattice broadening.

Similarly as with highly dispersed occluded foreign bodies of inorganic or organic compounds the occluded hydrogen then leads to changes in the properties of the metal.

According to the researches conducted, the hydrogen behaves on simultaneous discharging with the nickel quite differently according to the separation conditions.

1. The hydrogen is expelled at the cathode surface in a gaseous form or is occluded at the grain boundaries and macroscopic fault areas of the crystallites. In these cases the influence on the properties of the nickel remains very small.
2. The hydrogen is atomically dissolved or is absorbed by the nickel by means of hydride formation. There then occurs a broadening of the lattice. With hydride formation, besides the metal lattice a new lattice has to be considered.
3. The hydrogen is molecularly occluded in the lattice with the occurrence of strong lattice disturbances without change in the lattice constants. The hydrogen thus occluded causes strong changes in the properties just as with highly dispersed occluded other foreign bodies.

According to preliminary tests it has been found that with the electrolytic plating of iron similar relations should hold good as with the electroplating of nickel.

Hardness of Nickel Deposits

Anonymous: *Metalloberflaeche*, vol. 5, No. 7, p. B. 109.

In view of the present and future scarcity of nickel for plating purposes owing to rearmament demands, the subject is discussed of the preparation of nickel plating of greater hardness and as the resistance to mechanical wear depends primarily on this property, the matter is assuming increased technical importance. Formerly the hardness has been ascribed principally to hydrogen absorption but it has nevertheless been shown that the hardness is not reduced by expelling

the hydrogen by heat treatment which is so conducted that no change in the metal texture occurs by recrystallization. From this it was further assumed that the effect of the hydrogen, so far as it may be ascribed, is an indirect one. It has been further established that the deposit is harder, the more finely crystalline is the texture and the base metal has an influence on the texture of the plated deposit, inasmuch as the crystalline structure of the base metal is often repeated and continued into the plated deposit.

Colloidal additions can have further influence but in the case of gelatine additions it has nevertheless been established that only very small additions increase the hardness but larger additions however reduce the hardness and the extent of the effect of any particular addition is dependent on the temperature.

From the work of various researchers it has been further established that the sufate content of the bath is without special significance on the hardness of the deposit and also the nickel content has only a small influence and in the main only an indirect effect inasmuch as high nickel contents allow of the use of high current densities. By increasing the current density the hardness is increased up to a maximum value and when a certain current density value is passed the hardness again decreases. Thus increasing the current density between 0.5 and 10 amps./sq. dm. gave a hardness increase from 350 to 500 Vickers units and the lower part of the deposit was harder than the upper part of the deposit of thicker coatings. The bath content in ammonium salts also has a hardness increasing effect at least with the older low concentration nickel baths. Most definitely however with a higher chloride content a hardness increasing effect was established and at 60°C. this hardness increasing effect was stronger than at 40°C. but with a chloride content below 1.25 normal the effect was however reversed. A higher chloride content with the use of higher temperatures gives finely crystalline deposits. As regards the bath temperature a small increase acts at first in reducing the hardness; particularly with chloride rich baths, higher temperatures cause progressive hardness increase.

Zinc Plating from Acid Baths

R. Springer; *Metallaberflaeche;* vol. 5, No. 10, pp. B148-B154.

Regarding the influence of supersonic waves on zinc plating it was found that the supersonics had a very unfavorable influence on the zinc deposit formation. A greyish-black striated coating was formed. It was found that this influence was lower the higher the current density. The test bath contained 438 grms. $ZnSO_4$ plus 20 grms. H_3BO_3 plus 1 grm. H_2SO_4 plus 1,000 ec. H_2O and was used at a pH of 3.3 at 10-30 amps./sq. ft.

Investigation of the influence of various additions on the porosity of zinc deposits from acid zinc baths was conducted by using a special test method. The method involved the principle that cathodic hydrogen is deposited on plated coatings ond strips of thin steel sheet. If pores are present extending to the base metal the hydrogen generated penetrates to the iron and is absorbed by this. This renders the steel brittle and the bend cycle number of the sheet is reduced. The bend cycle number thus provides a direct measurement for the porosity of the plated coating. The plated coating thickness which is the minimum required so that the bend cycle number of the steel test strip is not changed by the hydrogen, is termed the "critical thickness." A spring steel was used for the test which was particularly sensitive to hydrogen embrittlement. The tests showed that this critical plating thickness becomes definitely smaller with increasing current density and increasing pH value. Additions of aluminum sulfate, ammonium chloride or an aromatic sulfonic acid reduced the critical thickness.

Regarding the influence of foreign metals in acid zinc baths, the following can be said. Copper is without noticeable influence up to a content of 0.02 grms./itre; higher copper contents cause roughening of the deposit and give the zinc deposit a dark color. The permissible maximum of manganese amounts to 1.0 grms./litre. With high contents spongy MnO2 is formed at the anode which passes to the cathode and roughens the surface. Cadmium is deposited with the zinc and contents of cadmium up to 5 grms./litre have a favorable influence. Iron has no adverse influence with contents up to 0.05 grms./litre but higher contents influence the current efficiency. Antimony gives needle-like growths with contents of more than 1 mg./litre and reduces the hardness of the zinc plating and the current efficiency. Cobalt gives rise to nodular deposits with contents higher than 12 mg./litre.

Tests made on addition agents for acid zinc baths showed beta-naphthol and pyrogallol as particularly suitable for this purpose. The tests were conducted in a 25% zinc sulfate solution at room temperature with a current density of 1.1 amp./sq. dm. for 2 hours. The amount of the organic addition to the bath was 1 grm./litre.

The Influence of Supersonics on Electroplating

A. Roll; *Zeitschrift fuer Metallkunde*, vol. 41, p. 413.

This describes the second part of research on this subject. In previous work on the electrolytic deposition of nickel it was found that supersonic waves influence the electrochemical dimensional factors in the same manner as does mechanical stirring of the solution. As the reason for this it was assumed that the hydrogen bubbles simultaneously deposited with the metal were accelerated in the supersonic field by the action of the supersonic waves pressur· and consequently rose more rapidly through the bath liquid. This more rapid movement had as an effect a stronger convectional movement of the electrolyte which serves to replace the mechanical stirring.

In further research, this assumption of the effect of the supersonic wave pressure was quantitatively determined. For this purpose the motion law of small gas bubbles in liquids was determined and compared with measurements of air bubbles which were caused to rise in a glycerine-water mixture by the effect of supersonics. The tests clearly showed that the greater rising velocity of the air bubbles is to be ascribed solely to the supersonic wave pressure.

Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Lowering Zinc Content

Question: We would like to know what correction is necessary for a zinc cyanide bath that has accumulated an unusually high zinc content? What measures do you recommend for the removal of the excess zinc?

G. S. R.

Answer: High zinc content usually does no harm, provided that the correct amounts of cyanide and caustic are also present to maintain the correct ratios between these compounds and the zinc. If the bath composition is so concentrated that excessive "salting out" occurs, the only remedy is to remove a portion of the bath and make up the level again with water.

You can lower the zinc content by removing the zinc anodes and operating the bath with stainless steel anodes until the metal content is lowered to the desired value, always maintaining the correct cyanide and caustic ratios.

Blistered Silver Plating on Steel

Question: We are having difficulty with blistering of silver plate on steel pins. We give these pins the conventional cleaning and acid dipping steps, then silver strike, second strike, and silver plate for 4 hours at 20 a.s.f. The pins are baked in hot oil after the heavy plating operation. The heavy plating can be pried off the steel base. Can you give us any help with this problem?

D. N. A.

Answer: Obviously your problem involves adhesion to the steel base. A suggested cleaning cycle would be alkaline clean, with a short reverse-current clean at the finish, rinse, acid dip, rinse. Adhesion is usually improved by using a flash coating of nickel under the silver, which is then followed by a silver strike before the main plating step. It is also best to bake the plated parts in an inert atmosphere such as nitrogen or hydrogen, although oil baths have been extensively used.

Test for Chromate Films on Zinc

Question: Do you know of any test that we could use to verify the presence of chromate films on zinc plated parts?

T. F. N.

Answer: Usually the color of the chromate film is sufficient evidence of its presence, but in the case of clear films the following test solution can be used for positive identification:

Distilled Water	40 ml.
Glacial Acetic acid	60 "
Diphenylcarbazide	1gram
Wetting agent (Sulfonated alcohol type)	.1 gm.
Hydrochloric acid (1.16)	15 ml.
Sodium hypochlorite	30 ml.
Hydrogen peroxide	5 ml.

The solution is made up by adding the constituents in the above order, then leaving the beaker stand about 24 hours to let excess chlorine escape. It can then be bottled.

A drop of this reagent is placed on the surface being tested, and if a chromate film is present a red or purple color will form in 1 minute.

Dummy Plating

Question: When using steel corrugated sheets for dummying a copper cyanide plating bath to remove heavy metal impurities, is it necessary to use all the front and back surface area in calculating how many amperes should flow through the system? Our sheets are hung near the tank sides, very much like anodes are hung.

F. F. J.

Answer: Most effective dummying is obtained when the solution being purified is allowed to flow past as large an area as possible of the dummy cathodes. This reduces the time and size of the dummy tank required. In such case, of course, it is necessary to calculate on the basis of both sides of the dummy sheet. When one side of your dummy sheet is shielded, as in your practice, the back area is doing very little, if any, purification work.

Carbonate Removal from Zinc Bath

Question: We are operating a zinc barrel which has over 12 oz./gal. of carbonate present, calculated as Na_2CO_3. We have been told that this carbonate can be precipitated with both calcium sulfate (gypsum) and slaked lime. Which of the two materials do you recommend for this purpose?

C. R. M.

Answer: The advantage of slaked lime over gypsum for precipitating carbonates depends on whether the plating bath being purified contains caustic soda or not. In the case of zinc, caustic soda is one of the principle constituents, so that the slaked lime would be better than the gypsum. Slaked lime restores caustic to the bath while precipitating carbonates

$$Ca(OH)_2 + Na_2CO_3 \rightarrow CaCO_3\downarrow + 2NaOH$$

In using gypsum, sodium sulfate is added to the bath when the carbonate precipitation reaction takes place

$$CaSO_4 + Na_2CO_3 \rightarrow CaCO_3\downarrow + Na_2SO_4$$

While the sodium sulfate does no harm, there is no sense in adding salts to plating baths when they do not serve a useful purpose.

Faulty Zinc Bright Dipping

Question: In bright dipping after zinc plating some deep cup-shaped steel parts, we get very erratic colors, especially down in the recesses. In some cases the bottoms of the recesses are quite dark, while other areas are all right. Can you give us any idea of

what could cause this type of trouble?

P. O. Z.

Answer: Several factors are working against you in this problem. In the first place, due to the deeply recessed shape, you may not be getting a sufficient thickness of zinc down to the bottom of the recess. As some zinc is removed during the bright dip, it is possible to strip all the thin zinc coating off and expose the steel, which would give no brightness and would appear dark. Secondly, if your zinc solution is contaminated with heavy metals such as lead or copper, these may be plating out down in the recesses due to low current density prevailing there. Zinc deposits contaminated with such metals will also give a dark, streaked appearance after bright dipping. The answer to your problem would be to get more zinc down in the recesses, either by increasing the overall thickness or using an inside anode, or removal of any heavy metal impurities with zinc dust or dummy plating at low current density.

Checking Silver Plate Thickness on Brass

Question: What is a good practical way to check the thickness of silver plating on a brass part of tubular shape? The silver plating is .0002"-.0005" thick.

S. J. W.

Answer: We believe a dropping test (jet test) would be suitable for rapid production testing, but the microscopic method should be used as an occasional check. The reagent for silver is made up of

250 gm./l Potassium Iodide
7.44 gm./l. Iodine

This reagent will penetrate .0001" of silver in 5.6 seconds at 77°F., or the same thickness in 6.6 seconds at 64°F.

Alkaline Cleaning and Coppering Bath

Question: We have heard that one of our competitors is using a single solution for alkaline cleaning and copper striking his steel parts all at once. Can you give us any details?

F. T. R.

Answer: This is a rather old technique, and although it is not seen very often in the U. S., it is still widely used in European countries. It is simply an alkaline cleaner with a small amount of copper cyanide added. The composition is not critical, and the following bath is typical:

Caustic soda	6 oz./gal.
Trisodium phosphate	4 "
Sodium carbonate	2 "
Sodium cyanide	1 "
Copper cyanide	½ "

The bath deposits a thin copper plate as the surface is cleaned (parts cathodic), and due to the hydrogen over-voltage of the copper being greater than that of the bare steel, the cleaning action is claimed to concentrate on the still-uncleaned areas. Those who use the process say that it does a thorough job of cleaning and is a little faster than straight cathodic cleaning in non-coppering baths.

Chrome Contamination of Cleaners

Question: One of our workmen disobeyed orders and stripped several chrome plated parts in the regular alkaline cleaning baths that we use for production cleaning of steel parts. When this used to be a regular practice at this plant we had considerable trouble with adhesion of subsequent nickel plating. Naturally we want to avoid this trouble again, and would like to know if there is any way the contaminated cleaner can be salvaged, as it is a fairly large bath and costs considerable to make up.

W. A. J.

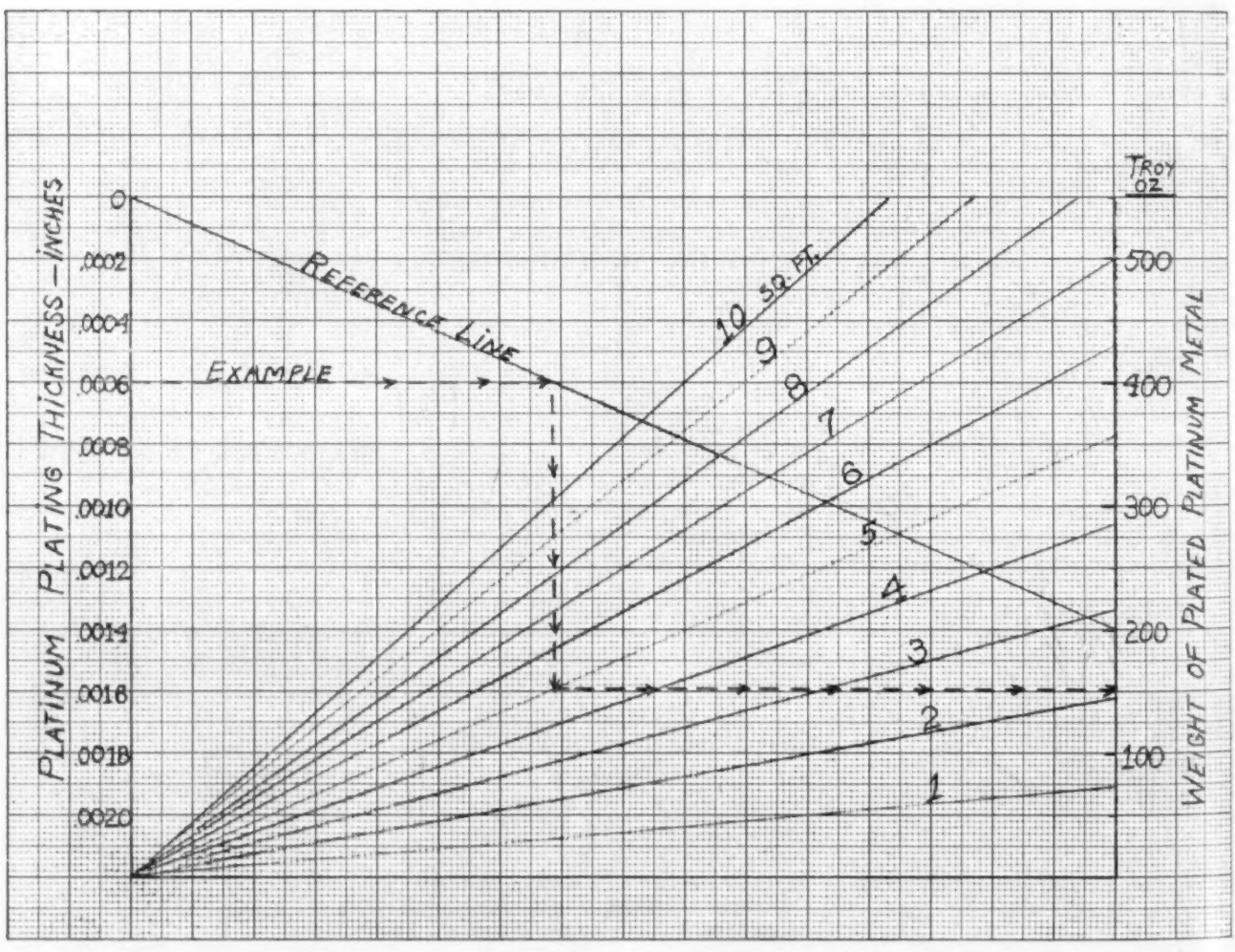
Answer: Small amounts of chrome contamination can be neutralized by adding a small amount of sodium hydrosulfite to the cleaner bath. While this does not remove the chromium from the bath, it does reduce it to the trivalent form in which it is not harmful. The cleaner will have to be kept doctored up until the chrome is removed by normal dragout, but for a large tank this would take a long time. Before dragout would reduce the chromium to this extent it is very likely that the cleaner bath would be spent and require dumping anyway.

Calculating Metal Cost for Platinum Plating

The chart below simplifies the metal weight and cost calculations for platinum plating. The example shown is for calculating the cost of plating .0006" of platinum on a surface area of 5 square feet. Lighter or heavier coatings than shown in the table can be calculated using appropriate factors. For example, .00006" of rhodium on the above area would be 1/10 of the above thickness.

Metal weights are given in grams.

Grams × .0322 = Troy ounces



Recently Granted Patents
in the Metal Finishing Field

Patents

Tumbling Barrel

U. S. Patent 2,565,385. *J. Lupo.*

In a tumbling barrel, an open-ended tubular metallic shell having contiguous angularly disposed portions defining side walls, said walls having outwardly projecting flanges at the longitudinal edges thereof with the flanges of each wall disposed in confronting relation with a flange of the adjacent walls respectively, flanged metallic heads fitted within the opposite ends of said tubular shell with the flanges thereof directed inwardly and rigidly secured to alternately spaced side walls of said shell to thereby provide a rigid barrel structure, means removably securing the remaining alternate side walls of said shell to the flanges of said heads and to the flanges of the rigidly secured side walls to permit of access to the barrel by removing any of said removable side walls, and a sectional lining arranged within the barrel adapted to be removed and replaced through openings in the tubular shell obtained by removing said removable side walls.

Brightening Tin-Coated Strip

U. S. Patent 2,566,468 *E. S. Taylerson, assignor to U. S. Steel Co.*

The method of treating steel strip having a coating of tin electrodeposited thereon in which the strip while in motion as a strand is heated to the melting point of the coating by passing a controlled electric current therethrough, characterized by passing said strip during said heating by said current through a shield of a heat conducting material around said strip, imparting heat to the outer surfaces of said shield, controlling the amount of heat imparted to said shield independently of said controlled electric current through said strip to maintain said shield at a temperature approaching but below the melting point of tin whereby a uniform melting of the tin coating across the width of the strip is achieved and control of said melting remains in the aforementioned controlled current, and quenching the strip immediately after the tin coating becomes molten.

Chemical Polishing of Tungsten

U. S. Patent 2,566,615. *G. W. Keilholtz and M. J. Bergin, assignors to Sylvania Electric Products, Inc.*

The process of reducing the diameter of coiled tungsten wire which comprises bathing the coiled tungsten wire in an agitated solution of alkaline potassium ferricyanide.

Conductive Transparent Films on Vitreous Surfaces

U. S. Patent 2,567,331. *R. A. Gaiser and J. W. McAuley, assignors to Libbey-Owens-Ford Glass Co.*

The method of producing a transparent electrically conducting film on a vitreous surface which comprises heating said surface to approximately its point of softening and exposing the heated surface to the action of an organic tin compound in fluid form which will form an electro-conductive tin oxide coating when such compound is brought into contact with a heated vitreous base without the formation of HCl vapors.

Stress-Measuring Instrument for Plating

U. S. Patent 2,568,713. *A. Brenner, assignor to the United States of America.*

An instrument for use in determining the stress in an electrodeposit during the deposition of a metallic coating on a metal base, comprising a metallic helix having one deposit-receiving cylindrical surface and an opposite surface protected by a deposit-inhibiting film, a helix clamping sleeve provided with an electric terminal, a suspending framework provided with a depending tubular portion, an insulating sleeve on said tubular portion against which said helix is clamped by said clamping sleeve, a lower insulating plug within the helix provided with a longitudinal aperture for a rod, a lower clamping sleeve for compressing said helix against said plug, a torque transmitting rod within said sleeve non-rotatably connected with said plug, a revoluble motion multiplying means operatively coupled with said torque-transmitting rod, and an indicator for registering said multiplied motion.

Chromate Treatment for Aluminum

U. S. Patent 2,568,936. *F. P. Spruance, Jr., assignor to American Chemical Paint Co.*

In the art of coating aluminum to increase its resistance to corrosion and abrasion where the surface of the metal has been coated by subjecting it to the action of an acid aqueous solution the essential coating-producing ingredients of which are fluoride ions, dichromate ions and ions from the class of acids consisting of phosphoric and arsenic acids; the method which consists in treating a surface so coated with an acid aqueous solution containing, as its essential active material, a mixture of chromic acid with acid from the group consisting of phosphoric acid and arsenic acid; the concentration of chromic acid to be from 0.5 to 40 grams per liter and the concentration of chromic acid to be from 0.5 to 40 grams per liter and the concentration of acid from said group being the stoichiometric equivalent of from 2 to 30 grams per liter calculated as P_2O_5.

Lead-Indium Alloy Plating

U. S. Patent 2,567,934. *D. F. Green, N. P. Mallet and J. M. Briscoe, assignors to Vandervell Products, Ltd.*

A process of electro-depositing an alloy of lead and indium which comprises the steps of preparing a non-aqueous solution of about 20 grams per liter of indium as perchlorate and 1 to 12 grams per liter of lead as perchlorate dissolved in ethoxyethyl alcohol, passing a current through the electrodes while maintaining the cathode current density at about 7 to 10 amperes per square foot, the alloy electro-deposited ranging from 90 to

1% indium and the balance lead, the anode containing an alloy of lead and indium with slightly higher percentage of indium than in the deposit and maintaining the bath temperature from 60 to 80°C.

Flux Bath for Aluminum Hot-Dipping

U. S. Patent 2,569,097. *H. L. Grange and D. K. Hanink, assignors to General Motors Corp.*

A method of coating ferrous metal with a coating metal of the class consisting of aluminum and aluminum base alloys which comprises immersing the ferrous metal in a fused salt bath composed about as follows:

37 to 57%, KCl
25 to 45%, NaCl
8 to 20%, Na_3AlF_6
0.5 to 12%, AlF_3

said fused salt bath being activated by aluminum in contact with the fused salt, said fused salt bath being at a temperature within the range of about 1250°F. to 1600°F., said ferrous metal having a temperature at least as high as the melting point of the said coating metal while in said activated salt bath, then immersing the ferrous metal in a molten bath of said coating metal while the ferrous metal is at a temperature at least as high as the melting point of said metal coating bath and thereafter removing the coated ferrous metal from said metal coating bath.

Test Paper for Alkaline Chromate Concentrations

U. S. Patent 2,569,663. *H. E. Frank and M. A. Hanson, assignors to Dearborn Chemical Co.*

A method for the determination of chromate concentration in an alkaline chromate solution of unknown concentration, which comprises impregnating a white bibulous sheet with an aqueous acid solution of from 60 to 160 grams per liter of solution of a crystalline organic acid selected from the group consisting of citric acid and from 3 to 8 grams per liter of solution of a compound selected from the group consisting of benzidine, hydrochloric acid and acetic acid derivatives of benzidine, drying said impregnated sheet and placing a drop of said alkaline chromate solution on said dry sheet, the concentration of said acid and of said compound in said sheet being such that upon contact of said drop with said sheet a color will develop

within the range from blue through golden to brownish gold depending upon the concentration of the chromate in said chromate solution.

Continuous Plating One Side of Strip

U. S. Patent 2,569,577. *H. J. Reading, assignor to National Steel Corp.*

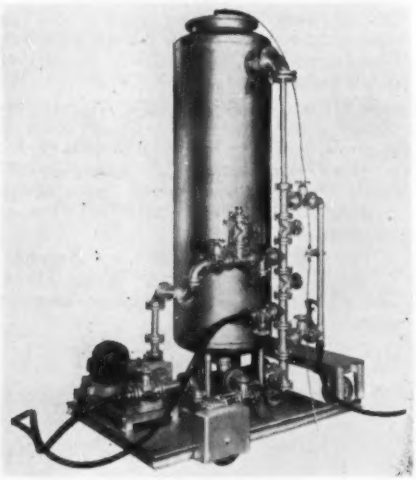
1. In apparatus for progressively electroplating only the bottom surface of strip with protective metal while the strip is continuously moving along a path, said apparatus comprising an electroplating cell including open tray means adapted to confine an open bath of electroplating solution, said tray means having an upwardly extending wall at its entry end terminating below the path of the strip, sidewalls at opposite sides of the tray means extending above the path of the strip, and wall means at the exit end of the tray means extending above the path of the strip whereby substantially all of the solution circulating through the cell flows rearwardly across the top of the wall at the entry end of the cell in a direction countercurrently to the direction of strip travel; a soluble anode of protective metal in the tray means below the path of the strip; means connecting the anode and the strip to a source of electroplating current as anode and cathode, respectively; means for supporting and horizontally moving the strip forwardly along such path across the tray from the entry end to the exit end with the bottom of the surface in contact with the bath and above the anode at a speed of at least 1,000 feet per minute whereby only the bottom surface is electroplated with anode metal; and means for discharging electroplating solution into said tray and against said strip, said last mentioned means consisting of means including an outlet positioned above the path of the strip arranged to discharge electroplating solution onto the top surface of the strip and consisting of means extending into the tray below the path of the strip and having a single outlet orifice positioned below the path of the strip between the anode and the wall at the entry end of the tray and arranged to discharge a single stream of electroplating solution upwardly against the bottom surface of the strip in a zone at the middle of the strip width adjacent the entry end of the tray and ahead of the anode.

Recent Developments

New Methods, Materials and Equipment for the Metal Finishing Industries

Recovering Chromic Acid

Illinois Water Treatment Co., Dept. MF, 840 Cedar St., Rockford, Ill.



The above firm announces a portable version of its Chrome Purifier for recovering and purifying chromic acid anodizing baths and reclaiming plating and rinse waters.

The Chrome Purifier, newest of Illco-Way developments in ionXchange engineering, eliminates the necessity of discarding chromic acid, which is normally replaced with fresh acid to maintain a required pH and acid concentration. Contamination of the acid solution is kept at a minimum when processed by this method.

In plating, the new Illco-Way Chrome Purifier permits recovery of contaminated chrome plating baths which must otherwise be discarded. Clear solutions produced by this method reduce current requirements and provide uniform plating, resulting in fewer rejects.

The Illco-Way Chrome Purifier is available in four standard sizes, each size available in stationary models (for permanent installation) and portable models (for treatment of several solutions located throughout the plant).

Portable units are easily moved and stored and thus do not take up valuable plant production space.

Cold Phosphating Solution

Du-Lite Chemical Co., Dept. MF, Middletown, Conn.

This firm has just developed Phospray, a new, cold spray bonding solution which can be applied with ordinary spray equipment. Phospray eliminates preparatory steps such as cleaning, rinsing, drying etc., it is claimed. It is simply sprayed on the product where it dries immeditely, ready for application of the final finish. It can be used for all metals except aluminum, and can be cut as high as three parts thinner to one part Phospray without reducing its effectiveness, according to the firm. Phospray has been thoroughly tested to government test specifications, withstanding conditions of humidity, salt spray, etc., while furnishing the bond for a coating of paint 150 mm. thick. Phospray, a patented process, is available in 120 lb. containers.

Further details may be obtained by writing.

Drying Metals by Water Displacement

Enthone, Inc., Dept. MF, 442 Elm St., New Haven, Conn.

A new water shedding compound known as Water Displacing Liquid No. 51 has been added to the line of water shedding agents already produced by the above firm. The manufacturer claims that this new product offers specific advantages over those previously announced.

These products are light liquids designed to displace water films from the surface of any metal, thus facilitating rapid, stain-free drying. The water is repelled from the metal surfaces and settles separately to the bottom of the container. According to the manufacturer, water is forced out of crevices and holes in the parts with light agitation of the parts. Tarnishing, staining, and deposition of solid residues are said to be prevented by the thin film remaining after evaporation of the solvent at room temperature. This thin film can be removed conveniently by vapor or liquid solvent degreasing if a perfectly clean surface is required for lacquering or enameling.

It is claimed that Water Displacing Liquid No. 51 leaves a scarcely detectable liquid film which offers moderate protection against rusting or corrosion. This film is said to be compatible with most rust-proofing and lubricating oils. The liquid is a convenient material for drying phosphated coatings, which have a great tendency to retain water. As Water Displacing Liquid No. 51 is said to shed water rapidly, the parts can be transferred without delay to the rust-proofing or lubricating oil normally used.

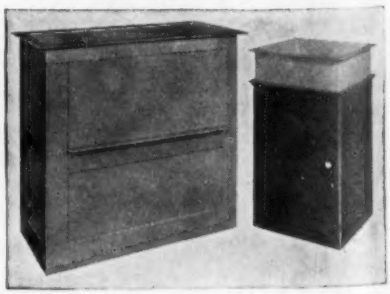
The manufacturer states that the combination of Water Displacing Liquid No. 51 and Enthone's Emulsion Cleaner 75 offers a convenient method of cold cleaning in tool rooms or machine shops to remove oil, dust, chips and other solid dirt. The work is immersed in Emulsion Cleaner 75, rinsed with cold water and immersed in Water Displacing Liquid No. 51 to shed the water film and leave a thin protective coating after evaporation of the solvent at room temperature.

More complete information may be acquired by addressing requests to the above address.

Tanks Fabricated from Rigid Polyvinyl Chloride

Munray Products, Inc., Dept. MF, 12400 Crossburn Ave., Cleveland 11, O.

Polydur — an unplasticized polyvinyl chloride rigid plastic—is now



available from this firm in the form of fabricated tanks, hoods, vents, ducts, etc., as well as in miscellaneous industrial equipment for use where highly corrosive conditions prevail. Tanks are being made in two types—self-supporting made from Polydur Sheets ¼" to 1" thick, and liners for wood, concrete or metal tanks, in which case Polydur Sheets of ⅛" thickness are used.

The many advantages of Polydur adapt it for use in many industries. It can be used with highly corrosive materials since it is claimed to be capable of resisting acids, alkalies, salts, oxidizing agents, oils, greases, alcohols, gasoline, carbon tetrachloride, etc., up to 170°F. without dimensional deformation and without loss of chemical properties at higher temperatures. Included in the corrosive materials to which Polydur is resistant are such items as acetic acid, nitric acid, concentrated sulphuric acid, ammonium nitrate, and other strong oxidizing agents.

At temperatures of 250° to 300°F. Polydur can be formed and welded into almost any design. Polydur does not deteriorate with age, is a good dielectric, is self-extinguishing, and does not become brittle at sub-zero temperatures, according to this firm.

Being much lighter than aluminum and yet having nearly as great tensile strength, Polydur (within its temperature limits) can often replace expensive alloys in many applications at an initial saving and with lower maintenance costs. Polydur fabricated tanks and products require neither external nor internal coatings.

Polydur is made entirely from domestic ingredients which assures a constant supply as well as better uniformity.

Wire Re-inforced Rubber Hose

Carlyle Rubber Co., Dept. MF, 62 Park Place, New York 7, N. Y.

This firm has a complete line of wire-reinforced flexible rubber tubing and hose suitable for many industrial operations of vacuum, blowing, air cleaning, filling, exhausting, etc. The tubing will convey practically all materials, including highly abrasive materials such as sand and metal particles. Sizes from ¾" to 12" I.D. are carried in stock in long lengths up to 25' (for the largest sizes).

This tubing has a smooth bore and

bends into small radii without kinking or flattening, it is claimed. Further information and prices are available from the above address.

Anode Bags

Alamac Buff Co., Dept. MF, 2 Christie St., New York 2, N. Y.

This firm announces a line of anode bags at low prices. These bags are made of 86/93 unbleached muslin or canvas, and are stitched with overlock seams and have a strong tie string, thus insuring long life. Anode bags of all sizes are made to order, with rapid delivery dates. Complete details and prices may be obtained by writing to the above address.

Surface Active Agent for Eliminating Plating Stains

Haas Miller Corp., Dept. MF, 4th & Eristol Sts., Philadelphia 40, Pa.

Immunol, a neutral, non-ionic liquid originally developed for use in long dilution with water as a rust preventive and detergent, has been adapted to use in rinsing after plating to eliminate water stains. Added to the final rinse, Immunol is claimed to prevent the rinse water from coalescing to cause stains on plated parts after removal from the rinse, and at the same time protects bright finishes. Immunol requires no special handling or preparation and is non-inflammable and non-toxic. Bath temperatures may be hot or cold depending on individual cycles. The need for buffing or hand polishing operations normally used for stain removal is eliminated by the simple, practical application of Immunol to your final rinse water, it is claimed.

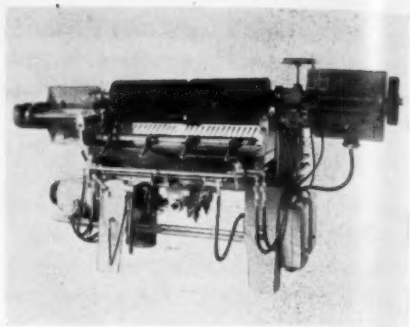
A brochure describing this and many other applications for Immunol is available upon request.

Polishing Spoon and Fork Handles

Clair Manufacturing Co., Dept. MF, 1009 S. Union St., Olean, N. Y.

The Clair Model 208 surface finishing machine is a new development designed to eliminate serious time-consuming operations in the surface finishing of spoon handles, fork handles and similarly shaped products. Although developed for a specific use through cooperation between Clair and several large silverware manufacturers, the machine is not limited to silverware applications.

The Clair Model 208 Machine allows



batches of work to be transferred as units from one holding rack to another between bowl and handle operations. Before the development of this new machine, the practice in the industry was to finish the spoon bowls on the Model 204 Spoon and Fork Machine, remove them from the racks and place them in tote boxes, then either resort to hand finishing or reload them in another rack for finishing the handles on another machine. These procedures were excessively time-consuming and also made necessary substantial numbers of reworks because of mars and scratches due to the additional handling involved. According to the manufacturer, the Model 208 Machine with its batch-handling rack feature, considerably speeds up production and also reduces the number of rejects.

When originally constructed the Clair Model 208 Machine had the small spindle for finishing the backs of the handles at top, while the large spindle for finishing handle fronts was on the bottom. This arrangement permitted acceptable surface finish, but required extra effort on the part of the operator. On transferring the loads from the bowl-finishing machine, the operator had to turn the racks upside down before they were placed in the handle machine. Since 60 to 120 racks per hour were involved, Clair re-designed the machine, inverting the surface finishing rolls so that the racks did not have to be turned over.

Operated by either 7½ or 10 horsepower motors, the Clair Model 208 machine has an automatic hydraulic "in" and "out" stroke which is adjustable from ¾" to 24". It is equipped with an air circut which provides automatic float of buffs at any predetermined uniform pressure. The standard machine is built with a safety bar across the front which controls instantaneous opening of the rolls during loading or as an emergency measure. Among a wide variety of optional

features are controls which open rolls and arrest all actuation at the completion of any predetermined number of strokes from 1 to 400.

In addition to silverware the machine is recommended by the manufacturer for surface finishing plier handles, surgical instruments, carving forks and many other curved items.

Additional details may be obtained by writing.

Wet Blast Chemicals

American Wheelabrator & Equipment Corp., Dept. MF, Mishawaka, Ind.

A complete line of abrasives for wet blasting machines is available directly from stock, according to an announcement made by this firm. Sizes supplied range from 80 to 2500 mesh, and they are packaged in convenient 50-lb. weights for easy charging of the machine and storage simplification. They are shipped in sturdy corrugated cartons which withstand rough handling. American Wheelabrator is also prepared to provide from stock all of the other chemicals needed for wet blasting. Anarust, the company's rust inhibitor, embodies two characteristics new to inhibitors: Being in liquid form it goes in solution immediately and it virtually eliminates the staining normally expected with inhibited water. Anaset, an anti-packing chemical, completes the company's line of wet blasting supplies.

Universal pH Meter

North American Philips Co., Inc., Dept. MF, 750 South Fulton Ave., Mount Vernon, N. Y.

A new Philips Universal pH Meter, precision built for reliable service and for quick, accurate measurements of hydrogen-ion concentrations, is now available.

The new instrument is designed for all pH and rH work, for potentiometric

titrations, and for oxidation-reduction-potential investigations.

For laboratory research and industrial testing purposes it provides a measuring accuracy of 0.01 pH or 0.5 m.v., a range of 0-14.15 pH and 0-1415 m.v., absolutely currentless measuring with no phenomena of polarization, zero indication by cathode ray tube, can be used with glass, quinhydrone, hydrogen and platinum electrodes, and is direct calibrated for the first three.

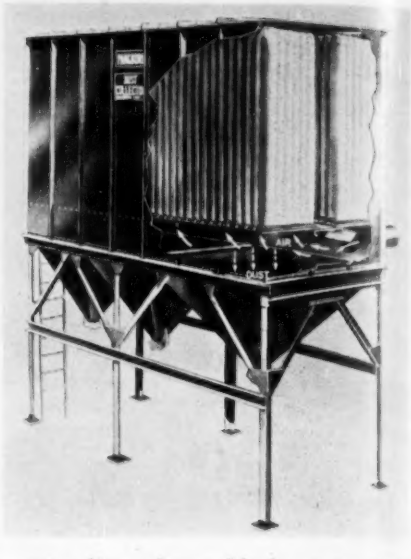
The pH meter is supplied with the new, removable Philips calomel and glass electrode and is provided with controls which correct for temperature variations and for asymmetric potentials. Unit has a built-in Philips cadmium standard cell and a flexible cable with a plug for connection to a 60 cycle a.c. power supply circuit. Transformer taps can be changed to accommodate voltages of 110, 125, 145, 200, 220 and 245.

Complete assembly consisting of the pH meter and auxiliary chemical equipment in two separate cabinets are designed for precise measurements of milli-voltage and hydrogen-ion concentration. In the latter work, it can help control completeness of precipitation, coagulation, flocculation, rate of settling, absorption, crystallization, speed or completeness of reaction, speed of filtration, and corrosion.

Cloth-Bag Dust Collector

Pangborn Corp., Dept. MF, Hagerstown, Md.

This firm offers a new cloth-bag collector for dusts such as carbon black, cork, fine wood, graphite, pigments, lime, lamp black, soap, fine tobacco, metal oxides and other dusts with similar characteristics. Simplified design of filter bags and mechanism for reclaiming dust from the bags, provides dust control at low equipment and installation cost, it is claimed.



In order to satisfy dust collection requirements, Pangborn cloth-big dust collectors range from 5 to 40 feet long, contain 1,360 to 10,880 square feet of filter cloth, employ from one to six hoppers, and are supplied with the appropriate structural supports to furnish the type of disposal desired—wheel-barrow, car, truck, etc.

Bags are fastened, open-end down, by wing-nuts to suspension members. Each bag contains a rubber hem at the open nozzle end to insure dust-tight fitting of bags to grid plate. The nozzles, by clamping a hand knob, are sealed over grid openings in the floor of the collector. Minimum number of parts, simplified design, and easy accessibility provided by a walk-way between the bags, make it possible to maintain and inspect the collector easily and without tools.

When the equipment is in operation, dust-laden air piped from the plant enters the collector at a point just under the grid floor. The air loses velocity and the heavier particles fall immediately into hoppers. The air then rises through the grid into filter bags sealed over each grid opening. All air passes through the bags on its way to the air outlet at the top of the collector.

Dust captured in the bags is removed by shutting down the exhauster and turning on the shaker motor. The shaking and bag suspension members

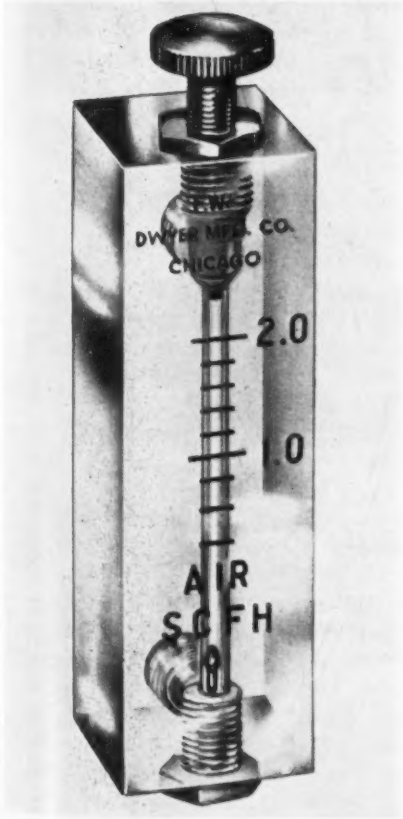
are combined to prevent duplication of parts and to simplify collector design. Dust shaken from the bags falls through the grid openings into hoppers. Opening a valve at the bottom of the hopper discharges dust from the collector for reclamation or disposal.

High Accuracy In Flowmeters

F. W. Dwyer Mfg. Co., Dept. MF, 317 S. Western Ave., Chicago 12, Ill.

Eliminating inaccurate bubble counting and watch timing, a line of new type precision flowmeters has been introduced by the above firm. Regardless of any change in flow rate of gas or air in laboratory test work, or when used as a replacement for sight-feed bubblers, it is only necessary for the observer to step to the Dwyer Flowmeter and read the line flow, it is claimed.

Of solid acrylic construction, Dwyer flowmeters are said to be precision drilled, reamed and polished to form a sturdy, accurate, easily read type of instrument. The standard unit includes a built-in control valve. Special scale ranges are available when ordered in productive quantities. Single units or one-piece multiple units for 0-2 C.F.H. to 0-10 C.F.H. at standard conditions are made for front-of-board or flush panel mounting, with mounting holes furnished to specifications.



Special Dwyer Flowmeters are available for liquids or gases, flush or surface mounted with any type connectors, brass or stainless steel fittings. Maximum conditions, 0-3 C.F.M. air and 75 p.s.i. Complete information may be had by writing.

New Oil to Replace Palm Oil in Continuous Galvanizing

Archer-Daniels-Midland Co., Dept. MF, 600 Roanoke Bldg., Minneapolis 2, Minn.

A new oil stripping medium developed by this firm is said to offer important economies and improved results in the hot dip tin and terne plating industries.

According to *Frank Haas*, A.D.M. vice-president, the new composition overcomes the most serious objections to palm oil and other traditional stripping oils.

Under the high temperatures at which oil stripping is commonly done, palm oil gradually decomposes and increases in body and viscosity. It generally becomes necessary to replace at least 25% of the oil every two weeks in order to maintain satisfactory performance.

In contrast, the new material is said to be so stable that decomposition is negligible. After a continuous six months' test, it still retained all the original properties required of a satisfactory stripping oil. No additions were necessary except to replace the oil carried away as film on the finished product.

This, of course, results in important economies and an improved product.

Because the oil retains its original quality, a lower percentage of the sheets must be re-run because of imperfections or sold at a reduced price.

Tin plate made with the new stripping medium has shown better enamel adhesion than obtained with the use of palm oil or the other fatty triglycerides commonly used, according to the firm.

The smoke and odor which result from the decomposition of palm oil is greatly reduced by use of the new formula, it is claimed.

Surface Active Agents

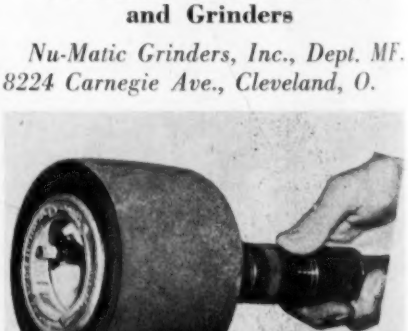
Alrose Chemical Co., Dept. MF, Providence 1, R. I.

Two new surface active agents, called Sorbit, have been announced by this firm. One is a paste, the other a flake product, but otherwise identical. The materials act as sequestering agents for calcium, magnesium, copper, nickel, zinc and tin ions, rendering salts of these metals soluble. They also act as solubilizers, causing many organic materials to become soluble in water.

Some suggested uses in the metal finishing field are in alkaline cleaners, where they aid in skimming soil and debris from the bath surface, and as a penetrant in phosphoric and oxalic acid type derusting agents. Complete details may be obtained by writing.

Pneumatic Drum Sanders and Grinders

Nu-Matic Grinders, Inc., Dept. MF, 8224 Carnegie Ave., Cleveland, O.



In this Nu-Matic polishing and grinding wheel the abrasive belt rides on a cushion of air contained in the inflated rubber drum. The drums can be inflated to various pressures for contour grinding and polishing if desired. The drum is adaptable to flexible shaft type machines, and finds many uses in the busy shop, but it can also be adapted to machine mounting similar to other grinding wheels.

Grits up to 180 (alum. oxide) are available in the belts. Complete details may be obtained by writing to the above address.

Molten Salt Bath Descaling and DeRusting

Hooker Electrochemical Co., Dept. MF, Niagara Falls, N. Y.

Today, many manufacturing and industrial firms find that they are unable to replace used or corroded parts.

A workman is shown lowering a tray of fittings into a molten salt bath as the first step in the Virgo Molten Cleaner process for cleaning cast iron and steel flanges, nickel pipe and other miscellaneous pipe fittings and chemical equipment.

Through the use of Virgo molten cleaner, Hooker's most recently developed metal cleaning agent, one company has completely cleaned an assortment of cast iron and steel flanges, nickel pipe and other miscellaneous pipe fittings and chemical equipment. In addition, 190 assorted nickel and alloy valves which previously had been rejected for repair by the manufacturer, were processed and made acceptable for re-conditioning.

Hooker for years has manufactured a product known as Virgo descaling salt, which is widely used in the stainless steel industry for descaling. Virgo Molten Cleaner, a more recent product, was developed for desanding castings and other metal cleaning applications. The Hooker Process is relatively simple and rapid, consisting of immersion of the metals in a molten salt bath operating at a temperature of about 850°F., a water quench tank and an acid dip tank. Unlike conventional acid pickling operations, Virgo Molten Cleaner does not attack the base metals of the parts cleaned, it is claimed.

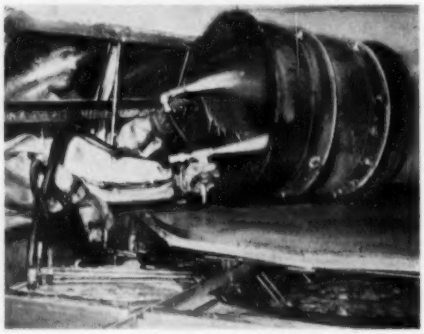
Aircraft Firm Cleans Jet Engine Parts With Wet-Blasting Unit

The Cro-Plate Co., Inc., Dept. MF, 747 Windsor St., Hartford 5, Conn.

As part of its continuing effort to improve the dependability of aircraft engines, *Pratt & Whitney Aircraft* division of United Aircraft Corp., East Hartford, Conn., recently installed a large custom-built wet-blasting unit manufactured by the above company.

The new wet-blasting equipment is used primarily for celaning experimental jet engine parts after the assembled engine has been run and then dissembled for inspection. At the extremely high temperatures at which jet engines operate, turbine sections and exhaust ducts become covered with a hard, tough coating of lead sulphate and lead oxide which is literally "baked on."

This coating has to be completely removed in order to properly inspect



the engine parts after the test-running. Pratt & Whitney Aircraft's inspection procedure calls for the parts to be immersed, after cleaning, in a Zyglo bath (penetrating oil) and then to be exposed to "black" light. Cracks that may have developed during the running of the engine show up clearly in this light. Absolute cleanliness of the parts is required since any surface contamination would defeat the inspection.

The coating mentioned clings so tenaciously that it has to be eroded off. For this, wet-blasting proved to be the only practicable cleaning method.

The custom-built unit is housed in an 8-ft. cube, with a 5-ft. by 7-ft. opening at the right side of the cabinet. Through this opening can be rolled out a 6½-ft. turntable (supported by an angle-iron framework) for easy loading of the larger-sized components; the turntable is then rolled back inside the cabinet for the cleaning operation. Three operators can work at the unit at one time, with each operating one or two wet-blasting "guns."

Tarnish and Corrosion Resistant Coating

The Center Chemical Corporation, Dept. MF, Riverbed & Center Sts., Cleveland 13, O.

Dodec is a semi-hard, film forming material designed to prevent tarnish and corrosion against atmospheric and storage conditions. Films are deposited in the range of .0001" or less in thickness on the surfaces of metals, offering protection at a very low cost. This film is bonded to metal surfaces, allowing handling and mild abrasion in from five to ten minutes after application, it is claimed. Dodec film is said to permit 180°F. bend without cracking or chipping, is insoluble in water, but soluble in the organic solvents normally used in industry. Dodec film prevents attack of the atmospheric gases such as hydrogen sulfide, carbon dioxide and others which have a tendency to tarnish or oxidize the surface of non-ferrous and ferrous alloys. Dodec films deposited from a volatile solvent are non-toxic, non-flammable and bacteriostatic, according to the firm.

Samples of silver plate, over steel and copper panels, were coated with Dodec film and subjected to an atmosphere of water saturated with hydrogen sulfide gas for periods of twelve to forty-eight hours and showed excel-

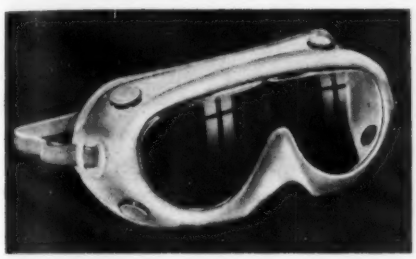
lent protection against tarnish and corrosion, it is claimed. NOTE:—Silver plate and sterling have shown no noticeable tarnish for over ten months testing in laboratory atmospheric conditions.

Dodec film may be easily removed by any of the normal industrial methods, such as ordinary solvents or vapor degreasing, which is the most efficient.

The research staff of the Center Chemical Corporation welcomes all inquiries and will provide any additional information or assistance required in the application of Dodec.

Acid Safety Goggle

United States Safety Service Co., Dept. MF, 1215 McGee, Kansas City 6, Mo.



A new acid safety goggle, named "Duo-Chem," features a bright yellow vinyl frame, the American Standards Association color code for acids, which affords quick visual identification of it as an Acid Goggle.

Light weight and genuine comfort are claimed by the manufacturer through the use of a new materials such as velvet soft vinyl frames and vinyl optical plastic lens.

The bright yellow vinyl frame is soft enough to mold in a tight seal to facial contours and has maximum resistance to acids and alkalis, it is claimed. Metal hoods over screen vents offer safe, adequate ventilation.

The one-piece lens is made from a special vinyl acid resistant optical plastic which is claimed not to stain or discolor from acid fumes, vapors or splashes. The lens is replaceable and can be quickly and easily removed. It is optically correct and meets Federal Specifications for impact resistance, according to the firm.

The manufacturer claims that the Duo-Chem officers full protection from all chemical splashes and dusts. It will fit over personal glasses and because of its extreme light weight (a little over one ounce) and attractive appearance, it should receive fine employee acceptance. It is in the low cost field and the long life of the materials used and the interchangeable lens feature offer further savings.

Acid-Proof Work Clothes

Mine Safety Appliances Co., Dept. MF, Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa.

Work clothes made of the new Dynel fabric have been announced by the above firm. Called M.S.A. ChemKlos, they are said to resist acids, caustics, wear, moths, mildew, shrinkage, snagging and tearing.

Keeping work clothes on the job in industrial operations using acids or caustics has long been a major problem to both management and personnel. The high replacement cost of ordinary work clothes that have been eaten away or damaged after comparatively short service can be substantially reduced by the use of M.S.A. ChemKlos, which resist corrosive chemicals, it is claimed.

Available in shirts, trousers and coveralls, M.S.A. ChemKlos offer complete protection, yet are comfortable and neat-appearing garments, according to the firm. They are easily cleaned and are not harmed by commercial dry-cleaning and washing solvents in concentrations hard on ordinary fabrics.

Dynel fabric has been tested and proved inherently chemical-resistant. The resistant qualities are in the fabric itself, not added by a treating process. Complete details are included in Bulletin No. CF-28, available without charge.

Manufacturers' Literature

Polishing and Buffing Machines

Hammond Machinery Builders, Inc., Dept. MF, 1601 Douglas Ave., Kalamazoo, Mich.

This firm has recently released an informative catalog covering their complete line of abrasive belt and wheel grinding, polishing, and buffing machinery. The new Catalog No. 75 describes their bench and floor-type wheel grinders; and Hammond Polishing lathes and backstands of various sizes and capacities for abrasive belt applications. Needed accessories for buffing and polishing operations are also featured.

Complete information and specifications on the Hammond Cyclone and Filter-Type Duskolectors complete the catalog.

Write for your copy.

Carbon and Graphite Products

National Carbon Co., Div. of Union Carbide and Carbon Corp., Dept. MF, 30 E. 42nd St., New York 17, N. Y.

A new 20-page Catalog Section describing and illustrating "National" Carbon and Graphite and "Karbate" Impervious Carbon and Graphite products is now available from the above firm.

Products made of carbon and graphite in grades from porous to impervious for applications in the chemical and process, metallurgical, mechanical and electrical fields are fully described. Information is given on sizes and physical characteristics of each product, in addition to many useful tables such as, Typical Physical Properties of Carbon and Graphite Products, Corrosion Resistance of "Karbate" Products, Heat Conductivity of Various Materials, Performance Curves of "Karbate" Pumps, Permeability of Porous Carbon and Graphite, etc.

Various types of impervious graphite heat exchangers, pipe, fittings and valves, centrifugal pumps, towers and accessories; carbon or graphite structural shapes, brick and cement, blast furnace linings, mill and foundry products, electric furnace electrodes, motor and generator brushes, mechanical applications and ground anodes for cathodic protection, are but some of the many illustrated products.

The principal features of carbon and graphite, whether porous, regular or impervious, are: resistance to practically all corrosive chemicals, high heat transfer of graphite products and low heat transfer of carbon products, ease of machining and fabrication, resistance to severe thermal shock, low thermal expansion, strength maintained with no deformation at high temperatures and good electrical conductivity.

A copy of Catalog Section S-5005 may be obtained by writing.

Filters

Niagara Filter Corp., Dept. MF, 3080 Main St., Buffalo 14, N. Y.

A new booklet published by this firm illustrates, by cutaway drawings, the advantages of their type of filter construction, together with the auxiliary equipment required for handling liquids in every type of chemical operation. Made in a wide range of sizes, and in materials for resistance to practically every industrial corrosive, these filters are claimed to permit great ease of operation, and cleaning. Copies of this helpful brochure on filtration may be obtained by writing to the above address.

Airflow Buffs and Wheels

United Buff Products Corp., Dept. MF, 241 Oak St., Passaic, N. J.

A new brochure just published by

the above firm "The Key to Your Finishing Problems" gives concise information as to how the firm's line of pressure-cooled buffs and contour backup wheels can cut finishing costs to the bone and produce top quality work. The features of this type of construction are explained and illustrated, and recommendations for various types of buffing, coloring operations are made. Write for your copy of this informative folder.

Acid-Resistant Work Clothes

Mine Safety Appliances Co., Dept. MF, Braddock, Thomas and Meade St., Pittsburgh, Pa.

A folder issued by this firm illustrates and describes their line of Dynel work clothes for chemical workers. The folder shows the various construction features that make these work clothes easily laundered and long wearing. Dynel cloth resists acids and alkalies, and are made in a wide variety of types and sizes. Write for your copy of this illustrative folder.

Liquid Level Controls

B/W Controller Corp., Dept. MF, Birmingham, Mich.

A folder recently issued by this firm illustrates and describes their line of relay-type electronic controllers for automatically controlling the level of liquids in tanks. No floats are used in their systems, which operate from permanently mounted electrodes suspended in the tank. No vacuum tubes are used, nor are there any moving parts exposed to the action of the liquid being controlled. The instruments will control variations in level from ¼" and up, and are claimed to be unaffected by pressure, temperature or corrosive solutions. Send for your copy of this folder.

Delivery of Flow Meters Aided by New Predictable Performance "Floats"

Fischer & Porter Co., Dept. MF, 5580 County Line Rd., Hatboro, Pa.

A new development, predictable metering floats for "area" flow-rate meters, now for the first time makes it possible to stock meters for immediate shipment.

Literature giving full specifications, capacities, sizes, and dimensions of the instruments effected by this development is now ready for distribution.

TECHNICAL LITERATURE

B.D.S. Chromizing Process

Tech. Report F-TR-1183-ND. Pub. by Air Materiel Command, Wright-Patterson Air Force Base, Dayton, O. Photostatic Copies, 33 pages. Price $5.00.

This report of the German B.D.S. chromizing process, widely used in Germany during World War II for applying a corrosion-resistant chromium coating on ordnance and aircraft parts, was gathered by the Technical Intelligence Division of the Intelligence Department. It gives complete details of how the process was carried out in several large German plants, as well as engineering data from the laboratory reports of these plants on the properties of the coatings.

Cleaning and Preparation of Metals for Electroplating

A.E.S. Research Report 18. Pub. by the American Electroplaters Society, P.O. Box 168, Jenkintown, Pa. Price $1.65. Paper bound.

This is the complete report of Project No. 12 of the A.E.S. Research program, and covers a critical review of the literature on metal cleaning, methods developed for soiling and cleaning of test panels, and evaluation tests for metal cleanliness.

Journals of the Electrodepositors Technical Society—Volumes 25 & 26

Published by the E.T.S., 27 Islington High St., London Nl, England. Cloth bound. Price to non members $6.00 each.

Volume 25 contains the papers and discussions of the papers presented at the various E.T.S. sectional meeting throughout the year 1949-50, as follows:

- Disposal of Plating Wastes
- Batch Production of Nickel and Chrome Plating
- B.N.F. Jet Tests for Cadmium
- Corrosion of Cadmium and Zinc in Electrical Equipment
- Plated Bearings
- Black Oxide Finishes
- Throwing Power
- Economics of Metal Rectifiers for Plating
- Nature and Uses of Diffraction
- Influence of Surface Behavior on Deposits
- Electrodeposits as Bases for Paints
- Bright Silver Plating in the Tableware Industry
- Structure of Deposits
- Works Organization in the Metal Finishing Trade

Volume 26 contains the papers and discussions presented at the Silver Jubilee Conference of the E.T.S. held in April 1950. The following papers are included:

- Electropolishing of Nickel in Molten Salts
- Measuring Surface "Truth" in Metal Polishing
- Commercial Electropolishing of Stainless Steels
- New Developments in Electropolishing
- Plating Copper-Cadmium Alloys from Cyanide Baths
- Plating Tin-Cadmium Alloys
- Lead-Tin Alloy Plating for Solderability
- Deposition and Properties of Speculum Plate
- X-Ray Structure of Speculum Deposits
- Discontinuities in Metallic Plated Coatings
- Plating Tin from Fluoborate Baths
- Etching Aluminum for Direct Plating
- Emulsion Cleaning of Metals
- Surface Active Agents in Metal Cleaning
- Education in the Plating Industry
- Interpretation of Specifications for Plated Coatings

Rapid Identification (Spot Testing) of Metals and Alloys

Pub. by International Nickel Co., 67 Wall St., N. Y. 5, N. Y. Free.

As an aid in positive identification of many types of common metals and alloys this book should find wide use in sorting scrapmetal so vitally needed by the nations war plants. Only four reagents, plus a magnet are needed to carry out the tests described. Nine different white metals may be positively separated by this technique, including the various types of stainless steel and high nickel alloys. Copies may be obtained by writing to the above address.

Metal Industry Handbook and Directory

Pub. by Louis Cassier Co., Ltd., Dorset House, Stamford St., London. Free to subscribers of Metal Industry.

The 40th edition of this book consists of four major divisions; General Properties of the metals, Data and Tables, Plating and Finishing Section, and Directory of firms supplying equipment and materials (British). The Metal Finishing section contains articles on Sources of Current, Methods of Cleaning for Plating, Plating Solutions, Notes on Plating, Coloring Formulae, and Polishing and Buffing.

News from California

By Fred A. Herr

Glendale's newest plating shop was recently opened at 815 Milford Street by *Plating, Inc.* The shop occupies a 50′ x 70′ building representing, for building and equipment, an investment of $50,000, *L. Logan*, owner, reports.

The plant is equipped to do the copper, nickel and chrome plating and polishing of products manufactured by three other Logan-owned firms: *Logan Mfg. Co.*, producers of plumbing parts; *Logan Emergency Showers, Inc.*, manufacturers of emergency showers for plating shops and other industrial plants; and *Machinists, Inc.*

All polishing is by hand to achieve a jewel-like sheen on plumbing fixtures and parts. Polishing equipment consists of a left and right lathe with four double-end lathes, and provision for installing four more as needed.

The foreman of the shop is *B. C. Cardes*, who for some twenty years had owned and operated the Industrial Plating Co. in Glendale.

Logan declared that until the basic materials situation improves the facilities of the new shop will be devoted exclusively to finishing items produced by his own manufacturing firms. Job shop work may be undertaken later when the metal situation eases.

Another Los Angeles visitor near the end of the year was *Carlos Vich*, president of *Agencias Philco*, S.A., Lima, Peru, owner of one of the largest record pressing plants in South America. He operates a four-press record plant at present and plans to increase the capacity with additional equipment. Installation of a plating department, so that records can be pressed as well as final-processed in Lima, is contemplated for 1952, he declared. During his California visit he was guided through the plant of *Coast Export Co.* in Los Angeles by its president, *Paul Mayer*.

Earl Coffin, whose sale of his Palace Plating Works and consequent retirement from the plating field was announced in the December issue of METAL FINISHING, has been signally honored by the Metal Finishing Association of Southern California by being voted a life membership.

The action was taken, officers of the association reported, in order to enable Earl to attend association meetings despite his retirement from the industry.

Earl was one of the leading spirits in the foundation and operation of the MFA. He was a charter member, served as secretary and later as president, and at the time of his retirement from active business was a member of the association's board of directors.

Gene's Plating Works, 3918 East 14th St., Los Angeles, has construction underway on a new plant adjacent to the existing one to provide additional facilities required by increased demand for aircraft plating. New facilities will include a complete barrel plating and ball burnishing installation, with overhead monorail servicing it, for nickel, zinc and cadmium.

The advertising, public relations and sales promotion divisions of *Turco Products, Inc.*, have been moved into larger quarters in a new building at 832 East 62nd Street, Los Angeles, where some 2,000 square feet of office area are available for the sales promotion department, headed by *F. O. Warmes*, and the public relations department, headeby *C. F. Divine*.

The firm's equipment division, headed by *Art J. Bridwell*, has been

moved to 1136 East 60th Street, Los Angeles. Turco's main office and plant remain at 6135 S. Central Avenue, Los Angeles.

New England Lead Burning Co., of Woburn, Mass., announces the removal of its branch office for Northern California, Pacific Northwest and Rocky Mountain area, from downtown San Francisco to San Leandro, Calif., a suburb of Oakland. Southern California branch office is at Downey, Calif., on the outskirts of Los Angeles.

The firm specializes in lead protection work, including linings for plating tanks, manufacture of lead anodes, and installation of sheet lead in tanks and agitators for refineries.

Scarce metals thieves again made a foray in Southern California during the first week in January. The victim was *Surface Alloys, Inc.*, Los Angeles plating firm, from whose warehouse near the International Airport 4,500 pounds of nickel was stolen.

Crown City Plating Co., Pasadena, recently opened for operation a new cadmium department housed in a 75′ x 100′ former warehouse adjacent to the main plating plant at 165 South Fair Oaks Avenue. Equipped at a cost of $25,000, the cad section contains two 1,000 gallon cad tanks, 300 gallon copper, 700 gallon zinc tank, and two cadmium barrel platers.

Also installed is a new phosphatizing set-up for preparing items for painting. The new equipment is used in the finishing of scientific instruments and parts, water sprinklers and miscellaneous items. *Ray Bray* is plating division superintendent.

United States Spring & Bumper Co., 4951 Alcoa Avenue, Los Angeles, has completed a plant addition known as its Defense Production Building. The new unit houses the firm's link machining and assembly operations, track shoe heat treating and machining department, and a new bond room. Other divisions which have been transferred to the new building include the metallurgical department under *Edward Brocker*, including testing rooms and offices, and the inspection divisions maintained by the company and by the U. S. Army Ordnance inspection division.

Alert Supply Co., manufacturers of buffing and polishing compounds, has moved into larger quarters in a new building at 4755 East 49th Street, Vernon, Calif.

Modern plating and painting equipment, centerless and thread grinders, automatic milling and high production Kingsbury machines, plus a battery of drill presses, are included in the new equipment installed in the new factory of *Harcraft Brass*, a division of *Harvey Machine Co.*, Torrance, Calif. The new building occupies a 2½ acre sight adjacent to the Harvey Company's main plant on Western Avenue in Torrance.

Robert McCormick, of the U. S. Spring & Bumper Co.'s Los Angeles plating department is firmly convinced that miracles *do* happen. Bob dropped a solitaire diamond ring while at work and practically gave it up for lost when he realized that the shop floor was covered with a thick layer of sawdust. The sawdust, however, did not daunt *Romeo Dulac* of the company's maintenance department. Dulac sifted the sawdust with his hands and—McCormick still finds it hard to believe—found the diamond ring.

Sphinx Manufacturing Co., producers of brass plumbing supplies, has moved into a new plant at 2401 East 103rd Street, Los Angeles.

General Coating Corp., 2126 East 88th Street, Los Angeles, has an-

nounced name change to *General Aluminum Corp.*

Richard V. Sloan has been named manager of the new branch office recently opened by the dust control and engine and compressor divisions of *American Air Filter Co.*, at 6175 York Boulevard, Los Angeles.

A visitor to Los Angeles in January was *Bert Lewis*, of the Northwest Chemical Company, Detroit, Mich. Mr. Lewis, who motored west with Mrs. Lewis, spent a week in Los Angeles in conferences with *A. D. Gaskin* and *A. E. Perkins* of Alert Supply Co., west coast representatives for Northwest Chemical Co. Participating in the Los Angeles conferences was *William Cahill*, San Francisco representative.

THANKS FOR YOUR CHRISTMAS CARDS!!

We acknowledge with sincere thanks the kind thoughts expressed in the Christmas cards received from the following:

Allbright Associates.
Anderson, Eugene F.
Applied Engineering Associates.
Beaver, H. LeRoy.
Behr-Manning Corp.
Birdsall, G. W.
Boggess, T. R.
Burt, Fred.
Coren, Bertram.
Cuthbertson, J. W.
Diggin, Myron B.
Divine, B. Dalton.
Dow, Chemical Co.
Ellis, Ray.
Errico, Tony.
Faint, Edward.
Fletcher, Austin.
Foulke, D. Gardner.
Fotheringham, W. M.
Fulforth, Fred.
Fullerton, Art.
Garrett, Andy.
Genser Manufacturing Co.
Graham & Associates, Inc., Hugh H.
Great Lakes Carbon Corp.
Grupp, Geo. W.
Haas, Joseph.
Hague, Louis.
Harper, Bob.
Hartshorne, Derick.
Hazucha, Rudy.
Hierraluminio, S. A.
Hilliard, Don.
Hinterleitner, Ernest J.
Hogaboom, Geo. B.
Huston, Kenneth M.
Hydro Chemical Co., Inc.
Johnston, S.
Kellner, Henry L.
King, E. G.
Kushner, Joseph B.
Lancy, Leslie E.
Ledford, Ray.
Lewis, W. R.
Lewis Electrical Mfg. Co.
Lowenheim, Fred.
McKeon, Wilfred S.
Mercready, Handy & Van Denburgh.
Mohawk Metal Corp.
Musick, Ed.
Nadel, Milton.
Nankervis, Geo.
Nogle, George.
Oakite Products, Inc.
Payson, Al.
Phillips, Maurice J.
Puritan Manufacturing Co.
Rapid Electric Co.
Reinken, Lou.
Rinker, Ed.
Schore, George.
Serota, Louis.
Singleton Co.
Such, Irwin H.
Sundmark Supply Co.
Tajima, Sakai.
Tourney, Geo.
Tyson & Co., Inc., O. S.
Waters & Associates, Norman D.
Wein, Samuel.
Wernick, S.
Wieschhaus, L. J.

In return the staff of METAL FINISHING wishes all its readers a Happy and Prosperous New Year.

BUSINESS ITEMS

Buckeye Products Co. Rewards Long Time Service

In observance of their 25th anniversary in the employ of *The Buckeye Products Co.*, Cincinnati, manufacturers of buffing and polishing compositions, President *Arthur Hoffheimer* recently presented wrist watches to *Goble Russell* (on right) and *Carl Teschner* (on left). Russell is now Shop Superintendent, having started in 1926 as a laborer, while Teschner is a Machinist.

President Hoffheimer observes a double celebration at this time of the year since he is also a 25-year man, and was 70 years old the middle of January. He is the father of Arthur, Jr., also an official of The Buckeye Products Co., and Mrs. Richard Allen, New York City, and has three grandchildren.

John H. Gorman Supervises H-VW-M Customers Technical Service

John H. Gorman

John H. Gorman has recently joined the technical staff of the *Hanson-Van Winkle-Munning Co.*, Matawan, N. J., as electrochemist, and has been placed in charge of customers technical service.

After receiving a degree in chemistry from Western Reserve Univ., he spent considerable time in post graduate chemistry studies. Mr. Gorman has had a wide industrial experience as plating chemist, metallurgist and consultant in the electroplating field in the Chicago and Ohio areas.

Wood to Represent United Buff in New York State

Mr. Lindley S. Wood, of Syracuse, N. Y. has recently been appointed New York State representative for *United Buff Products Corp.*, of Passaic, N. J., makers of Airflow buffing and polishing wheels and Aircon contact wheels for belt polishing work. Mr. Wood has had long experience in industrial polishing work, and as a trained engineer is in a position to render efficient service to manufacturers.

Arndt Joins Heil Corp.

Heil Process Equipment Corp., manufacturers of chemical-proof equipment such as tanks and tank linings, anodes, heat exchangers, etc., have re-

cently appointed *Fred W. Arndt* as direct representative to cover the eastern states. His headquarters are at 152 West 42nd Street, New York, New York.

Mr. Arndt has several years experience as engineer and sales engineer in the process equipment field. He received his Chemical Engineering Degree from Pratt Institute and his M.S. Degree from Stevens Institute of Tech-

Fred W. Arndt

nology. After a training course at the Cleveland plant, he is now in a position to give engineering assistance in connection with the many corrosion resistant products fabricated by this firm.

Other recent additions to the Heil staff include the appointments of *Gordon McLean* as Design Engineer, and *George Gatzke* as Estimator. Mr. McLean is a chemical engineering graduate of Case Institute of Technology with several years engineering experience in the process equipment field. Mr. Gatzke is a chemical engineering graduate of Fenn College with several years experience in industry.

L. A. Dunn Joins Wyandotte Chemicals

Lloyd A. Dunn, well known since 1942 in mid-western metal finishing circles, has joined *Wyandotte Chemicals Corp.*, Chicago District sales and service staff.

A chemical graduate of Albion College, for the past five years Mr. Dunn has been a technical field representative in the electroplating industry. He previously spent four years with the Armour Research Foundation on metallurgical problems.

Lloyd A. Dunn

Mr. Dunn will headquarter in Wyandotte Chemicals Chicago office, 435 N. Michigan Avenue. He is a member of the American Electroplaters Society and the American Chemical Society.

Pennsalt Appoints Macon Ordnance Specialist

J. Ralph Macon has been appointed *Pennsylvania Salt Manufacturing Co.'s* sales and service specialist in the ordnance field, it was announced today by *Joseph J. Duffy, Jr.*, Sales Manager of the Foscoat and Industrial Cleaners Dept.

Mr. Macon joined Pennsalt in 1950 as an engineer in the Market Research Div., transferring to sales when the company began marketing phosphate coatings and lubricants for application

to steel prior to cold working. He is a native of Thomasville, Ga., and a graduate of Emory University in Atlanta. He is a member of the American Society for Metals.

In making his announcement, Mr. Duffy pointed out the increasing importance of the ordnance field and said he expected Mr. Macon's appointment to provide the increased service and coordination this field demands.

Dr. Abner Brenner New Chief of National Bureau of Standards Electrodeposition Section

Dr. Abner Brenner

Dr. Abner Brenner has been appointed Chief of the Electrodeposition Section of the National Bureau of Standards. The Electrodeposition Section is responsible for N.B.S. research on the nature of electroplating and the electrodeposition process, including properties of electrolytic solutions and deposits, and precise determination of the thickness of electroplated coatings.

Dr. Brenner has been engaged in electrodeposition research at the National Bureau of Standards since 1930, except for two years spent in N.B.S. laboratories in California. He has conducted extensive investigations of alloy deposition, especially tungsten and molybdenum with iron, nickel and cobalt, and on the nature of cathodic films.

A native of Kansas City, Missouri, Dr. Brenner received a B.A. in Chemistry from the University of Missouri in 1929, a M.S. in chemistry from the University of Wisconsin in 1930 and a Ph.D. in chemistry from the University of Maryland in 1939. He re-

ceived a research fellowship from the University of Wisconsin in 1930 and the Procter award for the best papers presented to the 1946 and 1948 annual conventions of the American Electroplaters Society.

Dr. Brenner is the author of many technical papers in the electroplating field on topics such as the corrosion-preventive values of electroplated coatings and the magnetic methods for measuring the thickness of electroplated coatings. He is the inventor of the Magnegage, an instrument for measuring the thickness of plated coatings, and of the spiral contractometer, and he has developed a process for the purification of rhodium plating solutions.

Dr. Brenner is a member of the American Chemical Society, the American Electroplaters Society, Electrodepositors Technical Society, the Electrochemical Society, the Washington Association of Scientists, Phi Beta Kappa and Sigma Xi.

Northwest Chemical Appoints Johnson Sales Co.

H. J. McCracken, president of *Northwest Chemical Co.*, Detroit 4, Mich., announces the appointment of *Johnson Sales Co.*, Montclair, New Jersey, as their Middle Atlantic States representative. With a background of a chemical degree from Johns Hopkins University and special courses in physical chemistry and electroplating at New York University, *Howard F. Johnson*, the principal of this organization, has had a liberal experience in the chemical, smelting and refining industries, holding executive positions with such companies as American Smelting & Refining Co., Nichols Copper (Phelps Dodge) Corp. and Lotte Chemical Co. "With this broad experience," says Mr. McCracken, "we are sure that Mr. Johnson will be able to give us the kind of sales engineering representation in this territory that our products require."

Howard Johnson

Buckeye Products Licenses South African Company

It was recently announced by *The Buckeye Products Co.*, Cincinnati that arrangements have been concluded for a licensing agreement with *Industrial Chemical Products, Ltd., Pty.*, Johannesburg, South Africa, whereby they will manufacture the complete line of Speedie buffing and polishing compositions. All Speedie compositions will be available in both South Africa and the Rhodesias in accordance with the agreement which was concluded in the general offices of the company between *Charles Wise*, Secretary of Buckeye and *Alexandre Lorant*, Director of Industrial Chemical Products, who made a special trip to Cincinnati during his recent visit to this country.

Dr. Thomas Joins the Electric Products Co.

The Electric Products Co., a leading manufacturer of special motors and generators since 1909, announces that *Dr. William A. Thomas* has joined their engineering staff. Dr. Thomas brings to his new position a wealth of technical experience gained not only from his teaching activities, but also

Dr. W. A. Thomas

from many years in design engineering and as a consultant for several companies.

Graduating from the Case Institute of Technology (Cleveland, O.), he joined the engineering department of General Electric at Schenectady. Leaving there in 1930, he spent the next ten years teaching and gaining his Master's and Doctor's Degrees in Engineering. During this period, he was an Instructor in Electrical Engineering at Yale and Professor of Electrical Engineering at Antioch College and Iowa State College.

From 1940 to 1948, he was an electrical engineer with the E. I. du Pont de Nemours, Inc. at Wilmington. In 1948, Dr. Thomas returned to Case as Professor of Electrical Engineering. From this post, he came to The Electric Products Co.

Active for many years in A.I.E.E. affairs, Dr. Thomas has been Director of the Iowa Section and Vice-Chairman and Treasurer of the Wilmington Sub-Section. At present, he is Chairman of the Basic Sciences Group of the Cleveland Section and is a member of the National Committee on Basic Sciences.

At the 1951 Fall Meeting of A.I.E.E. in Cleveland, Dr. Thomas delivered two papers: one on "*The Field Discharge Resistance of Synchronous Machines*" and the other on "*A New Method of Measuring Electrical Machinery Temperature.*"

Hooker Appoints Moore Sales Supervisor for Virgo Process

John N. Moore has been promoted to Virgo Sales Supervisor, according to an announcement by *R. E. Wilkin*, General Sales Manager of *Hooker*

Electrochemical Co., Niagara Falls, N. Y. Until his recent appointment, Mr. Moore was engaged in technical sales service for Virgo Descaling Salt and Virgo Molten Cleaner, and had been associated with development work on these products since 1946. His headquarters will be the Niagara Falls office.

Mr. Moore has been with Hooker since 1941 when he received his B.A. in Chemistry from Wesleyan University. He is a member of The American Society for Metals and the Wire Association.

Van Horn New Alcoa Research Director

Dr. Kent R. Van Horn, 46, one of the nation's leading research metallurgists and an authority on industrial X-ray, became *Aluminum Company of America's* director of research on January 1.

A veteran of 22 years with Alcoa, Dr. Van Horn will advance from the position of associate research director to succeed *Dr. Francis C. Frary*, who is retiring.

In his new job, Dr. Van Horn will be heading the aluminum industry's oldest and most extensive research organization. Its headquarters are at the Aluminum Research Laboratories, New Kensington, Pa. There are also three branches.

Kent R. Van Horn

Widely known for his articles in technical publications, and a member of 10 different technical and research societies, he has served (1944) as the youngest president the American Society for Metals ever had.

After graduating from Case Institute of Technology and completing post-graduate work at Yale University.

COMING EVENTS OF THE A. E. S.

New York Branch
Annual Educational Session and Banquet
February 16
Statler Hotel — New York, N. Y.

Dayton Branch
Annual Educational Session and Banquet
March 15
Biltmore Hotel — Dayton, Ohio

Boston Branch
Annual Educational Session and Banquet
April 19
Statler Hotel — Boston, Mass.

Los Angeles Branch
Annual Educational Session and Banquet
March 22
Roger Young Hall — Los Angeles, Calif.

Dr. Van Horn joined Alcoa in 1929 as a research metallurgist at the Cleveland division of the Aluminum Research Laboratories.

In 1945, Dr. Van Horn was advanced to chief of the division and in 1949 was made assistant director of research for the Cleveland branch. Eighteen months ago, he was transferred to the New Kensington headquarters, where he became associate director of research, the post he leaves to step up to the directorship.

A native of Cleveland, Dr. Van Horn obtained his Bachelor of Science degree from Case in 1926. He was the only member of his class to win three honor keys. At Yale, where Dr. Van Horn received his master's degree in 1928, he was granted the Sterling Research Fellowship. He obtained his Ph.D. from Yale in 1929.

Mercer Joins Pennsalt as Sales Engineer

Robert S. Mercer has joined *Pennsylvania Salt Mfg. Co.* as sales engineer on corrosion resistant products, it was announced by *Robert R. Pierce*, Sales Manager of the Corrosion Engineering Products Dept.

Mr. Mercer attended Drexel Institute, where he earned his Bachelor of Science degree in chemical engineering in 1935.

He is a member of the American Chemical Society. He and his family live in Phoenixville, Pa.

Rack Firm Moves to New Location

A recent move of *Corak, Inc.*, makers and coaters of plating racks and handling equipment, makes their new address Westgate Drive and Official Road, Addison, Illinois, a suburb of Chicago. Their new phone is EStebrook 9-1607.

Wm. Baker Elected V.P. of Boston Finishing Concern

Mr. William B. Baker was recently elected vice-president of the *Rust-Proofing and Metal Finishing Corp.*, of Cambridge, Mass. He has been with the firm since 1941, and since 1948 has been plant superintendant. The firm is one of the largest job finishing plants in the New England area.

Burkard and Anderson New Wyandotte Department Heads

P. N. Burkard, former Director of Technical Service for the *J. B. Ford Div.* of *Wyandotte Chemicals Corp.*, now heads the company's Industrial, Railroad and Aircraft Department. *Donald E. Anderson*, former Assistant Director of Technical Service now heads this department. Mr. Burkard succeeds *Dr. Roy Heath*. These changes were announced December 14 by *Robert L. Reeves*, General Manager of the J. B. Ford Division of the Wyandotte organization. *Robert J. Racine* continues as Manager of Industrial Sales.

Mr. Burkard joined the research staff of Wyandotte in 1938, transferred to the J. B. Ford Technical Service Department in '41, and became director of this activity in 1946. He is a graduate of University of Illinois, holds a master's degree in chemistry from Syracuse University and has done further graduate work at Wayne University in Detroit. He is a member of the American Chemical Society, American Institute of Chemists, Association of Analytical Chemists, Kiwanis, and has addressed many technical groups in this country and Canada.

Mr. Anderson has been a member

of the following Wyandotte Chemicals departments since joining the company in 1940—research, plant research, development, technical service and engineering. He has been Assistant Director of Technical Service for several years, is well known to trade groups throughout the country and has authored several technical articles. He is a chemical engineering graduate of Yale University, and is a member of the American Chemical Society and the American Institute of Chemical Engineers.

Heading Wyandotte Chemicals Sales of the Industrial, Railroad and Aircraft Industries. Left to right: James L. Ramsey, Manager Railroad Sales, P. N. Burkard, Newly appointed Manager of the Department, and Robert J. Racine, Manager Industrial Sales.

Sharples Chemicals Combines with Pennsalt

The combination of *Sharples Chemicals Inc.* with the *Pennsylvania Salt Manufacturing Co.* through an exchange of common stock has now been effected.

For the present Sharples will continue to operate as a separate unit of Pennsalt, with, however, an exchange of technical information and coordination of some policies to the mutual benefit of both organizations.

The combination with Sharples gives Pennsalt an established position in the synthetic organic chemical field —a field in which they have been increasing their activities and interest for several years.

Another advantage to the combina-

tion is that it assures Sharples a supply of some of its basic raw materials; chlorine, caustic soda and ammonia, which are produced at Pennsalt's Wyandotte plant, adjacent to the Sharples plant.

Mr. P. T. Sharples, chairman of the Board of Sharples Chemicals, Inc., has become a board member of Pennsalt.

United Platers Appoint Drury Sales Manager

Burton E. (Al) Drury, Jr., was named sales manager of *United Platers, Inc.*, effective January 1, 1952, *Glenn H. Friedt*, president, announced.

A native of Birmingham, Mich., Drury formerly was with Wilson Foundry & Machine Co. in Pontiac for nine years, the last five as sales manager.

Prior to going with Wilson, he had an extensive background in sales promotion and advertising, including two years with the Hudson Motor Car Co.

United Platers provides plating, rustproofing and metal processing service to the automotive and allied industries. At the present time, the company is shifting most of its production to defense projects.

Burton E. Drury, Jr.

Pennsalt of Wash. Appoints Two District Sales Managers

Richard A. Snyder and *Kenneth W. Montfort* have been appointed District Sales Managers for *Pennsylvania Salt Manufacturing Co.* of Wash., *William J. F. Francis*, Sales Manager of the Special Chemicals Divisions, announced today.

Mr. Snyder assumes the position of District Sales Manager of the Industrial Cleaners Div. and will head up the company's Los Angeles sales office. Prior to his new appointment he was technical sales and service representative for the company's line of metal and maintenance cleaners, with his headquarters in Berkeley. Mr. Snyder, a chemical engineering graduate of the University of Michigan, joined Pennsalt's Heavy Chemicals Sales Department in Tacoma in 1946. During World War II he served in the Army for nearly five years.

Mr. Montfort, formerly sales representative, becomes District Sales Manager of the Agricultural Chemicals Div. and will continue to make his headquarters at the company's office in Portland, Ore. He will supervise sales of agricultural chemicals in Oregon, Washington, Montana, Idaho, Utah, Colorado and British Columbia and other western Canadian provinces. Before joining Pennsalt he was Assistant Manager of Northwest Wholesale's

Chemical Supply Dept. in Wenatchee, Wash.

In addition to their new duties both men will continue to handle certain heavy chemical accounts in their territories, in collaboration with *Mr. Roy M. Shanaman*, Sales Manager of the Heavy Chemicals Division.

Standards for Plating Rectifiers

At a recent meeting of the Codesand Standards Committee of the National Electrical Manufacturers Ass'n., a number of changes and additions were approved for N.E.M.A. Standards for Metallic Rectifiers MRl-1950. These changes involve for the most part definitions of terms commonly used on such items as ripple voltage, ambient temperature, aging, measurement of stack temperatures, etc., for both copper oxide and selenium rectifiers. Copies of these latest changes may be obtained by writing to the Ass'n. at 155 E. 44 St., N. Y. 17, N. Y.

Webb Appointed Alkali Products Sales Manager by Detrex

W. H. Webb has been appointed sales manager of Alkali Products for *Detrex Corp.*, Detroit 32, Mich., according to an announcement by *A. O. Thalacker*, vice-president and general manager.

W. H. Webb

In the past ten years, Mr. Webb has advanced through the positions of Assistant Manager Alkali Division, Assistant National Accounts Manager and Central Region Manager. He has had wide experience in the plating and metal cleaning fields.

As Alkali Products Sales Manager, Mr. Webb will work closely with the specialized field personnel concentrating on serving the consumers of Detrex alkaline and emulsion cleaning materials.

United Buff Expands Its Sales and Distribution Set-up

The United Buff Products Corp., manufacturers of pressure-cooled Airflow buffs and Aircon contact wheels, announces several additions to its sales and nationwide distribution force.

In Wisconsin and Minnesota they are now represented by *R. L. Hundley*, located at 3100 W. Walnut St., Milwaukee 8, Wisc.

To cover the Northern Illinois, Iowa, and Nebraska section of the country they have appointed *Tom Means* and *Bill Johnson*, of 4th Ave. and 24th St., Rock Island, Ill., sales and service representatives.

In Louisianna and Mississippi, they have established sales and warehouse facilities at *Industrial Machinery, Inc.*, 501 N. Cortez St., New Orleans, Miss.

In the Detroit area, their headquarters is headed by *C. A. "Arv" Hubley*, at 10550 Grand River Ave., Detroit 4, Mich. Sales engineers are also located

in the Grand Rapids area to service the Western Michigan trade.

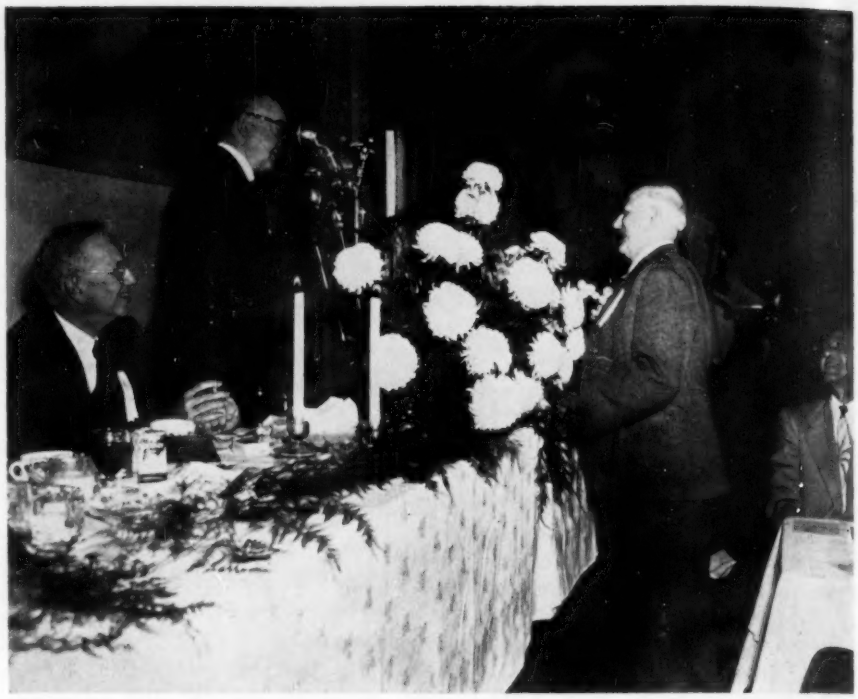
To cover the Canadian area, they have appointed the *Thomas Buff and Brush Co.*, 174 Catherine St. North, Hamilton, Ontario, Canada.

Pangborn Corporation Honors 25-Year Men

The Pangborn Corp., Hagerstown, Md., manufacturer of blast cleaning and dust control equipment, recently honored 77 veteran employees at the first annual dinner of the Pangborn Quarter-Century Club. These men, many with more than 25 years service, were awarded gold wrist watches and commended by company officials and employees alike for their part in the firm's success story.

Two hundred seventy-eight other Pangborn employees—all having over 10 years service and all being prospects of the Pangborn Quarter-Century Club—joined in the festivities and paid homage to the senior Pangbornites.

This dinner is the first of a perpetuity of future tributaries in recognition and appreciation of long years of loyal service. The firm feels that this loyalty has contributed so much to the growth and good fortunes of the corporation that it is one of the company's most valuable assets.



Howard W. Easton, machine assembler, receives gold watch from Thomas W. Pangborn, president. Seventy-seven other Pangbornites having over 25 years service were similarly honored. Easton is a veteran of 37 years with the firm, the second oldest employee in length of service. Victor F. Stine, vice president, is first, having a record of 39 years.

Oakite Representatives Receives Distinguished Service Award

J. W. Haines, technical service representative of *Oakite Products, Inc.*, manufacturers of industrial cleaning and allied materials, is here shown receiving the *D. C. Ball Award* for Distinguished Service from *John A. Carter*, Oakite president, as sales manager *Frank L. Oldroyd* looks on. The award, in the form of a bronze plaque, will be presented annually to the member of the firm's nationwide field organization adjudged to have rendered the most outstanding service to industry during the year. Presentation of the award, which is given in memory of *David Clifton Ball*, pioneer in industrial cleaning procedures, founder of the company, and chairman of its board of directors until his death last year, was made at December technical-sales conference of Oakite field representatives held at the Hotel Statler in New York City.

Jernstedt Named Engineering Manager for Westinghouse

George W. Jernstedt has been appointed Manager of Engineering for the Special Products Development Div. of *Westinghouse Electric Corp.*, Pittsburgh, Pa.

George W. Jernstedt

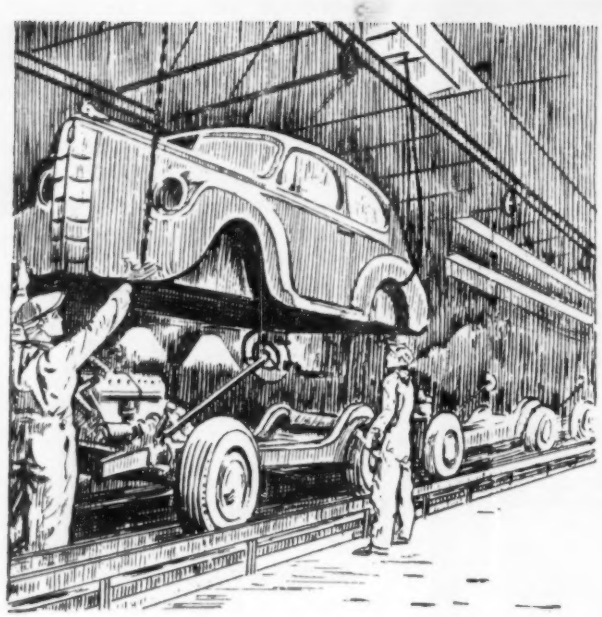
Mr. Jernstedt, presently in charge of Electroplating Projects, joined Westinghouse at the Meter Division in 1936 while an undergraduate at the Newark College of Engineering, the school from which he was graduated the following year. Mr. Jernstedt was granted a Lamme Scholarship in 1939 and during a one-year leave of absence from the Company obtained his Masters degree in chemical engineering from Michigan State College. He also completed three years of graduate work at the Polytechnic Institute of Brooklyn.

In 1943 he was transferred from the Meter Division to Engineering Laboratories and Standards, where he remained until taking charge of Electroplating Projects, in which capacity he will continue in addition to his new appointment.

Gilbert Tramer Co. Moves to New Quarters

The *Gilbert Tramer Co.* announces the opening of new offices and plant at 1217 Main Ave., Cleveland 13, O. They were formerly located at E. 110 St., Cleveland.

The firm handles a complete line of metal finishing supplies and equipment, and has a complete engineering service for plant installations and process development and control.



MOTOR CITY PLATING NEWS

by

Edward Finnie

The regular monthly meeting of the *Plating Institute* was held at the Detroit Athletic Club on Wednesday, December 12, 1951.

Members present were: R. Huber, Homer Welch, Manley Young, King Clifford, Web Knight, W. Crawford, E. Finnie, Bud Adelsperger, Al Adelsperger, W. Mogle, Glenn Friedt, Glenn Friedt, Jr., Paul Henning, John Hilfinger, Ray Shock and R. Sumners.

Following dinner, the meeting was called to order by *Bob Huber*, president. The major portion of the meeting was taken up with discussion on an agenda to be presented to the Advisory Committee on January 21st in Washington. The agenda agreed upon was:

1. Job Platers should have first opportunity for defense work.

2. More nickel and restricted items should be released to the platers until defense work hits its stride.

3. Ceiling prices should be established on metals.

4. Consideration of a tailored price ceiling on job plating prices.

6. To point out why the plating industry needs new equipment even though it had formerly stated that it was ready to do defense work.

Merkin & Lurie Industries, Silvercraft Div., have moved to a new building at 13711 Joy Road, Detroit 28 from their former address at 8307 Livernois. The new building, 40 x 70, will house the company's rapidly expanding silver plating business. At the present time, Merkin & Lurie are mainly performing industrial silver plating on bearings and various aircraft parts and assemblies, plus industrial gold plating. In addition, they are taking in the refinishing of antiques, although this phase of the business is rapidly becoming a sideline.

The company was started in 1945 by Sallan Lurie and Norman Merkin, primarily as a jewelry making organization. Shortly after entering into business, htey set up their own finishing department and this is now their primary function. Platingwise, they have come a long way since 1945.

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The Detroit branch of the A.E.S. and the Detroit Section of the Electrochemical Society held a well-attended joint meeting at the Hotel Statler on Friday, January 4th.

The main speaker of the evening was *Dr. Ralph A. Schaefer*, of the Cleveland Graphite Bronze Co. of Cleveland, Ohio whose subject, "*Some Practical Considerations of Current Distribution*" provoked some very serious thought on this problem.

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Cleve Nixon, formerly director of process development for the Ternstedt Division of General Motors, has been named to head the General Motors Research Electrochemistry department.

He will succeed *William Phillips*, who will remain on the research laboratory executive staff until he retires in September.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Boston Branch 16th Annual Banquet and Meeting

On April 19, 1952 the Boston Branch will have the following speakers at its 16th Annual Educational Session and Banquet at the Hotel Statler:

"*Modern Industrial Hard Chrome Plating*" by Arthur Logozzo, Pres., Nutmeg Chrome Corp., Hartford, Conn.

"*Present Day Decorative Plating*" by Cleveland F. Nixon, Pres. A.E.S., Gen. Motors Corp., Detroit, Mich.

"*Recent Developments in Plating Waste Disposal*" by Dr. Louis Weisberg, Consulting Engr., N. Y., N. Y.

The educational lectures will start at 2 p.m., and the Banquet and entertainment will take place at 7 p.m.

Newark Branch Annual Banquet and Educational Session

The decision to make their annual educational session and banquet a two-day affair in the interest of better attendance at both functions, ran afoul of the weather man on December 14th, when an early season sleet and snow storm completely disrupted the city of Newark and surroundings and cut the attendance at the Friday technical session down to a few hardy souls. Nevertheless, all the speakers managed to arrive (including *Dr. Walter Meyer*, who arrived just in time to say goodnight to departing members) and an informal discussion of the following subjects was held:

"*Filtration*," by Harold J. Faint, of Industrial Filter and Pump Co.

"*Galvanic Corrosion*," by Frank LaQue, of International Nickel Co.

The weather eased sufficiently the next day to permit a large turnout at the annual banquet and entertainment, as the accompanying picture will show.

Los Angeles Branch

Bert Lewis, of the *Northwest Chemical Co.*, Detroit, Mich., addressed Los Angeles Branch of the A.E.S. on the night of January 9 on the subject of

"Wetting Agents in Metal Cleaning Operations."

Preceding his talk Mr. Lewis gave the Los Angeles members an outline of what is being accomplished and sought in A.E.S. Research Project No. 12. He said that the Supreme Society research committee has sponsored some very good work on metal cleaning research into which has been assembled practically all the information known on cleaning for plating.

Lewis declared that many new materials have become available in the field of rubber, plastic and paint for rack coatings, tank linings, etc. Similarly, he said, new materials have come into use for cleaning. He explained the theory of chem-absorption in which a certain percentage of the material used in buffing and polishing becomes attached to the metal and is difficult to remove. He described chem-absorption as one of the more aggravating problems of metal cleaning. He also discussed cleaning by displacement, which he referred to as a reversal of the chem-absorption process, and cited degreasers and soap cleaners suitable for that work. The speaker declared that just about the only mechanical help one can get in cleaning under modern production methods is by the use of spray equipment, high-pressure washers or agitators.

President *Lostutter* presided over the business session. This first meeting of the new year drew a surprisingly large attendance of well over 100 members and guests.

Harry Rubin, of Ajax Hardware Co., *Bryant W. Barnes*, of Barber-Webb Co., and *Norman K. McKewan*, of Virtue Brothers, were inducted into membership.

It was announced that the Sidney, Australia Branch had requested that the Los Angeles Branch serve as its proxy delegate at the Chicago A.E.S. convention.

John Millhorn, chairman of the 1952 annual educational session and banquet, announced that the date of March 22 had been decided upon. The site will again be Rodger Young Hall in Los Angeles. The program as tentatively drawn calls for morning and afternoon technical sessions, a noon luncheon, and the annual banquet and ball in the evening. Arrangements are being made to accommodate 500 persons, Millhorn reported.

Rockford Branch Annual Session and Banquet

The Rockford Branch of the A.E.S. will hold their Annual Banquet and Educational Session on April 26, 1952. Program and speakers will be announced in the next issue.

Pittsburgh Branch

The Pittsburgh Branch of the A.E.S. held its annual Christmas Party at the Sheraton Hotel, Saturday, December 15. The fact that eight inches of snow had just covered the area and that roads were in a precarious driving condition did not deter the holiday spirit of approximately sixty (60) merrymakers. Continuous entertainment was had during the entire evening and *Faye Parker*, a well known radio star, did a wonderful job in giving the party a Christmas air. Refreshments were served throughout the evening. *M. G. S. Woodruff* and his committee deserve a vote of thanks for

their efforts in promoting this very successful affair. If the temperature had not been in the vicinity of zero we are quite certain that the crowd would have been increased fourfold. Perhaps the weatherman will be a little more generous to us next year.

Dayton Branch Annual Session

The annual educational session and banquet of the Dayton Branch of the A.E.S. will be held on March 15, at the Biltmore Hotel, Dayton, Ohio. Further details may be obtained from *H. Luechauer*, Publicity Chairman.

Baltimore-Washington Branch

The January meeting for the Baltimore-Washington Branch was a Tuesday, January 8th plant tour of the *Calvert Distilling Co.* of Relay, Maryland. Before the tour, a short business session was held to discuss several rather important issues that could not wait for the February meeting.

It was the opinion of all who attended that the Branch has never been treated to a more organized and courteous tour. Everyone was also impressed with the cleanliness of the entire plant.

Needless to say most of the party was put through the taste test, and about eighty per cent were "Men of Distinction."

New York Branch

The November meeting was called to order by the President, *Mr. George Herrmann*, on November 9th at the Hotel Statler, New York.

The following men were elected to membership and duly installed: *Mr. Harry Tsourmas*, *Mr. Seymour M. Karten*, *Mr. Martin Reich*, and *Mr. Joffe*.

A communication was received from the San Francisco Branch advocating that *Mr. Wooley* be elected as the third Vice-President at the annual meeting in Chicago. The communication was filed away under "Unfinished Business" until a later date.

After a discussion on the matter, the following motion was duly made, seconded and approved by the majority of the membership: The New York Branch go on record as opposing any type of advertising or, the endorsing of any commercial enterprises by the National Body of the American Electro-Platers Society.

A suggestion for amending the by-laws of the New York Branch presented by the Board of Managers was voted down by a majority of the members present.

Following the business meeting, a film entitled "The Air We Breathe" was shown.

Cincinnati Branch

Despite the fact that Christmas was just around the corner, the Cincinnati Branch of the A.E.S. had an outstanding turnout for an outstanding meeting on December 19, 1951. Starting with the usual delectable dinner, the meeting was called to order by President

R. D. Miller, who then called on the Secretary to read accumulated correspondence. Considerable discussion was devoted to 1st Vice-President *F. J. Mac Stoker's* letter of the possibility of inaugurating an A.E.S. Correspondence Course. Majority of those present requested additional information on how the course would be conducted, the cost, who would be eligible to take such a course, and the necessity of including some laboratory work in such a course. It was the opinion that most would favor such a course in electroplating.

Local members participated in a discussion forum which was led by *Ray Barry*, who talked on "Plating Die Castings," *J. F. Daymude*, who discussed "Alkaline Solution Plating — Oxide Coatings," *Allen Reed*, who took "Water Treatment and Sewage Disposal" as his subject and pointed out the necessity for water conservation, *Ed Roof*, who talked on "Plating on Brass," and *Bob Winston*, who concluded the meeting with an address on "Plating on Steel." The question and answer period proved to be unusually stimulating, so much so that the meeting was one of the longest on record, not adjourning until 10:15 when the members were the guests of the *Merchants Chemical Co.* for the usual Social Hour.

METAL FINISHING SUPPLIERS' ASSOCIATION, INC.

Letter to All M.F.S.A. Members from President Munning

December 28, 1951

Dear Member:

In the last few months there has been some discussion and perhaps some confusion because an advisory committee was formed at the N.P.A. and called "Advisory Committee for the Electroplating Industry" but was made up solely of job platers with no representation either of platers in manufacturing establishments or of supply houses or manufacturers of plating equipment, all of whom would be apt to be affected by any general legislation covering plating.

The confusion was further intensified by the fact that the first official action recommended by that committee was certainly one which would have affected a great many people other than job platers.

We have made a rather careful investigation at Washington and while the condition is not as good as perhaps might be liked by some people, it is not as bad as the facts above would seem to imply.

The title of the committee is a little misleading. This committee was formed by the Services Branch of the N.P.A.

The Services Branch has the func-

tion of supplying material to and generally supervising the action of, people who are not themselves manufacturers of any finished product but who simply do work of some character for others.

We are assured by the N.P.A. that it never was intended as a general plating committee and being an advisory committee attached to the Services Branch could only be composed of job platers and could not legally contain other elements of the industry.

It is unfortunate that the committee should have been named as it was and not called "Job Platers' Committee," because that is really what it is.

It is entirely possible that legislation might be advised by this committee which would affect other elements of the plating industry.

It must be borne in mind that the functions of any advisory committee are purely informative and advisory and under no circumstances have they the power to legislate. Their advice may be accepted or rejected by the N.P.A. entirely within its own discretion.

We are assured that before any legislation is enacted by the N.P.A. that would affect any element of the plating industry other than purely job platers that our organization as well as others, would be called upon to express opinions.

We believe that we will have ample opportunity to present views, if any legislation is contemplated as a result of advice offered by this committee even though circumstances prohibit representation on it.

We have also been in touch with the division handling and furnishing material to the manufacturers of plating equipment.

At the present time there is no advisory committee or legislation directly covering this class of manufacture. From what we can learn, we rather doubt that there will be unless either war becomes general or actual shortages begin to appear in plating equipment of any character.

We are and will continue to be in touch with this situation and we feel sure that if any change is contemplated at any time, that we will be consulted in advance of any action.

Very truly yours,
Metal Finishing Suppliers' Association, Inc.
A. P. MUNNING,
President.